MAY 29, 2001

DRAFT FINAL ADDENDUM SUBMITTAL
MODIFICATION #04

CENTRAL AND SOUTHERN FLORIDA PROJECT

TAMIAMI TRAIL ENGINEERING APPENDIX ADDENDUM

GENERAL REEVALUATION REPORT/ SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (GRR/SEIS)

MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK

US Army Corps of Engineers
Jacksonville District

07101-01

JULY 20, 2001

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CENTRAL AND SOUTHERN FLORIDA PROJECT

ENGINEERING APPENDIX FOR THE TAMIAMI TRAIL MODIFICATIONS

GENERAL REEVALUATION REPORT/SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT (GRR/SEIS)

MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK

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SYLLABUS

The Everglades National Park Protection and Expansion Act, December 1989, authorized the Secretary of the Army to undertake certain actions to improve water deliveries to the Everglades National Park (ENP) and to take steps to restore natural hydrologic conditions. The General Design Memorandum (GDM) called for in the Act was completed In June 1992. Under the provisions of this GDM and Environmental Impact Statement (EIS) for Modified Water Deliveries (MWD) to the ENP, water would be transferred from WCA-3B to the L-29 Canal (Tamiami Canal) and through the existing culvert system south under U.S. Highway 41 (the Tamiami Trail) into Northeast Shark River Slough. When the GDM was completed in 1992 it was believed that existing culverts under the roadway would be adequate to convey the flow of water. Subsequent hydrological analyses, however, revealed that the head height In the L-29 Canal required for the culverts to convey the increased water could adversely affect the structure of Tamiami Trail and overtop low areas along the highway under certain conditions. The purpose of this project is to identify a technical solution to provide modifications to the Tamiami Trail to provide for the unimpeded conveyance of water from WCA 3B and the L-29 Canal to the Northeast Shark River Slough and the Everglades National Park south of the Tamiami Trail. The project must provide compliance with the Reasonable and Prudent Alternatives (RPA) of the February I9, 1999, U.S. Fish and Wildlife Service Final Biological Opinion on the Cape Sable seaside sparrow. This calls for at least 30% of the regulatory water discharges from WCA 3A to be re-routed Into Northeast Shark River Slough beginning on March 1, 2000. These waters would traverse WCA 3B and the Tamiami Trail, and enter the Everglades National Park instead of being discharged through the S-12 structures. This would rise to 45% and 60% in March 1, 2001 and March 1, 2002, respectively. it is also required that the project be compatible with hydrologic restorations provided by the Comprehensive Everglades Restoration Program.

Under the Modified Waters Program, authorized by the Everglades National Park Protection and Expansion Act of 1989, water deliveries to the Everglades National Park (ENP) will be improved as a step to restore natural hydrologic conditions increased flows to the Everglades National Park. Water from the South Florida Water Management District Water Control Area (WCA 3B) will enter the L-29 Canal (Tamiami Canal), pass under U.S. Highway 41 (the Tamiami Trail), and enter the Everglades National Park. Hydrologic studies, however, have indicated that the resulting water levels in the L-29 Canal will be sufficiently high to saturate the road base and potentially damage the structure of the road. Overtopping of the road may occur in low areas. Information found in this engineering appendix has been used to select the preferred alternative and evaluate the plans' ability to provide for unimpeded flow of water from the L-29 Canal to Everglades National Park.

TAMIAMI TRAIL
MODIFIED WATER DELIVERIES TO EVERGLADES NATIONAL PARK

PERTINENT DATA

US 41/TAMIAMI TRAIL

West Project Limit	S-333 Sta. 580+46 on Levee 29
East Project Limit	S-334 Sta. 15+26 on Levee 29
Florida Dept. of Transportation State Route No.	S.R. 90
Florida Dept. of Transportation Section No.	870003
Florida Dept. of Transportation Functional Classification	Rural Arterial
Roadway Design Speed	60 mph
Roadway Posted Speed Limit	55 mph
Number of Existing Travel Lanes	2
Number of Future Travel Lanes	2
Existing Average Daily Traffic (1999)	5,200 vehicles
Projected Average Daily Traffic (2022)	9,200 vehicles
Percent Heavy Trucks	11.47%
Peak Hour to Daily Traffic Ratio	9.29%
Directional Distribution Factor	52.66%
Corridor Length	56,520 feet/ 10.7 miles
Datum	NGVD 29
Design Stage Upstream of L-29 Borrow Canal	10.5 feet
Design Stage at L-29 Borrow Canal	9.3 feet
Design State Downstream of US 41/Tamiami Trail	9.3 feet
Contract Price	
Alt. 6: Existing Alignment with 4-Mile Bridge and 8 Box Culverts: Without Water Quality Treatment	$ 72,877,979
With Water Quality Treatment	$ 81,369,677
Alt. 7: Existing Alignment with 3,000-Foot Bridge: Without Water Quality Treatment	$ 23,045,733
With Water Quality Treatment	$ 51,858,385
Alt. 8: Existing Alignment with Box Culverts Without Water Quality Treatment	$ 45,499,995
With Water Quality Treatment	$ 47,081,029

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CENTRAL AND SOUTHERN FLORIDA PROJECT FOR FLOOD CONTROL AND OTHER PURPOSES

TAMIAMI TRAIL
MODIFIED WATER DELIVERIES
TO EVERGLADES NATIONAL PARK

A. INTRODUCTION

1. Authorization

The Everglades National Park Protection and Expansion Act (PL101-229, Section 104, 16 U.S.C. Part 410r-5 *et seq*., December 1989 authorized the Secretary of the Army to undertake certain actions to improve water deliveries to the Everglades National Park (ENP) and to take steps to restore natural hydrologic conditions. This act provides the underlying authority for this project. Section 104 of the Act stated:

- The Everglades National Park is a nationally and internationally significant resource and the park has been adversely affected and continues to be adversely affected by external factors, which have altered the ecosystem including the natural hydrologic conditions within the park. Wildlife resources and their associated habitats have been adversely impacted by the alteration of natural hydrologic conditions within the park, which has contributed to an overall decline in Fishery resources and a 90 percent population loss of wading birds.

The Act also provided direction for the U.S. Army Corps of Engineers to initiate corrective actions to alleviate deterioration in natural resources of ENP attributed to changes in water conditions associated with construction of the Central and Southern Florida (C&SF) water management system. The Act stated:

- Upon completion of a final report by the Chief of the Army Corps of Engineers, the Secretary of the Army, in consultation with the Secretary, is authorized and directed to construct modifications to the Central and Southern Florida Project to improve water deliveries into the park and shall, to the extent practicable, take steps to restore the natural hydrological conditions within the park.

- Such modifications shall be based upon the Findings of the Secretary's experimental program authorized in section 1302 of the 1984 Supplemental Appropriations Act (97 Stat. 1292) and generally as set forth in a General Design Memorandum to be prepared by the Jacksonville District entitled "Modified Water Deliveries to Everglades National Park." The Draft of such Memorandum and the Final Memorandum, as prepared by the Jacksonville District, shall be submitted as promptly as practicable to the Committee on Energy and Natural Resources and the Committee on Environment and Public Works of the United States Senate and the Committee on Natural Resources and the Committee on Public Works and Transportation of the United States House of Representatives.

The General Design Memorandum (GDM) called for in the Act was completed in June 1992. This GDM and Environmental Impact Statement (EIS) for Modified Water Deliveries (MWD) to the Everglades National Park is the authorizing document for structural modifications and additions to the existing C&SF Project required for the modification of water deliveries for ecosystem restoration in the ENP. The 1992 GDM stated, "The future without project condition will lead to the further deterioration of unique and outstanding ecological resources of the Everglades that are recognized and valued throughout the world." Therefore, based an the direction provided in the Everglades National Park Protection and Expansion Act of 1989, the goal is to restore natural hydrologic conditions in the Park to the extent practicable. Meeting this goal will lead to improvements in the abundance, diversity and ecological integrity of native plants and animals in the Park."

Section 528 of the Water Resources Development Act enacted October 1996 (Public Law [PL] 102-580) was entitled "Everglades and South Florida Ecosystem Restoration," This authorized a number of ecosystem restoration studies, now collectively known as the Comprehensive Everglades Restoration Plan (CERP). As a result of this Act, the Corps submitted a report to Congress on July 1. 1999, containing this comprehensive blueprint for Everglades restoration. Implementation of CERP will further increase the flow of water entering Northeast Shark River Slough. The plan has been approved as the Water Resources and Development Act of 2000.

2. Purpose and Scope

Under the current authorized and approved plan, water would be transferred from Water Conservation Area 3A (WCA 3A) to WCA 3B by constructing three new water control structures at Levee L-67A and three new water control structures at Levee L-67C. Water would be passed from WCA-3B through S-355A and S-355B to the L-29 Canal and through the existing culvert system under U.S. Highway 41 (the Tamiami Trail) into Northeast Shark River Slough (ENP). When the GDM was completed in 1992 it was believed that existing culverts under the roadway would be adequate to convey the flow of water. Subsequent hydrological analyses, however, revealed that the hydraulic head in the L-29 Canal required for the culverts to convey the increased water could adversely affect the structure of Tamiami Trail and overtop the highway under certain conditions.

The purpose of this project is to identify a technical solution to provide for the unimpeded conveyance of water from Water Conservation Area 38 and the L-29 Canal north of the Tamiami Trail to the Northeast Shark River Slough and the Everglades National Park south of the Tamiami Trail.

In the eastern Everglades in the vicinity of Water Conservation Area 3B, the Modified Water Deliveries plan involves the construction of three gated culvert structures (S-345A, B, and C), three gated concrete headwall structures (S-349A, B, and C), and two spillway structures (S-355A and B). Also, the plan considers relocation of structure S-334, raising a portion of the Tamiami Trail (US 41), and degrading the existing Levee 67 Extension and filling the borrow canal. The recommended plan also includes flood mitigation in the residential area in the East Everglades. In addition, an airboat camp, and two Miccosukee Indian Camps were to be raised to prevent flood damages from occurring due to implementation of the project.

As an additional element of the overall project, it was recognized that modifications to the Tamiami Trail/US 41 corridor are required between spillway structures S-333 and S-334 to permit proper conveyance of the Modified Water Deliveries project maximum flows and to mitigate the impact of the resulting higher water surface elevations on the roadway and its subgrade.

To accomplish this objective, five initial alternatives and three additional alternatives were identified and analyzed with respect to their advantages and disadvantages. The results of this evaluation for the five initial alternatives are documented in the Engineering Appendix dated December 22, 2000, as part of the General Reevaluation Report/Supplemental Environmental Impact Statement (GRR/SEIS) for the Tamiami Trail Modified Water Deliveries Project. The three additional alternatives are analyzed in a similar fashion and are documented in this Engineering Appendix Addendum.

3. Overview of This Addendum to the Engineering Appendix

There were originally five basic alternatives identified for the Tamiami Trail study corridor. The analysis and evaluation of the technical aspects of these alternatives and other related issues, as well as general inventory and field investigation information, were documented in the Engineering Appendix – Final Submittal (dated December 22, 2000). Subsequent dialogue with stakeholder agencies regarding the original alternatives, the cost components associated with them, environmental factors, and potential Comprehensive Everglades Restoration Program (CERP) implications led to the identification of three additional alternatives which warranted further consideration.

This Addendum to the Engineering Appendix provides documentation of these three additional alternatives – identified as Alternatives 6, 7 and 8 – in a manner comparable to the original five alternatives. As such, these additional alternatives are analyzed and evaluated using the same design criteria, technical methodologies, and evaluation factors. This review is documented in a manner similar to that for the original alternatives.

This Addendum also includes some additional features which might be incorporated into any or all alternatives in some fashion potentially, as well as other supplemental analyses performed for the original five alternatives.

This document is intended to supplement the original Engineering Appendix, and accordingly, general information pertaining to the corridor and all eight alternatives which is presented in the original Engineering Appendix is not repeated in this Addendum.

B. ALTERNATIVES

4. Alternatives Considered

The process of alternatives analysis proceeded through a series of steps, as follows:

1. Identification of alternatives.
2. Review and refinement of alternatives [adjustments in alignment and typical section in relation to cost and impact issues].
3. Development of practical alternatives in greater detail.
4. Comparative evaluation.

The five alternatives originally considered in this analysis were the following:

a. Alternative 1: Existing Alignment and Profile with Four New Bridges.

b. Alternative 2: Existing Alignment with Raised Profile and Four New Bridges.

c. Alternative 3: New North Alignment with Raised Profile and Eight New Bridges.

d. Alternative 4: New South Alignment with Raised Profile and Four New Bridges.

e. Alternative 5: New Alignment on Structure.

For all but Alternative 1, a configuration was developed for each alternative which did not provide for roadway runoff water quality treatment (for example, Alt. 2A) and a second configuration which did provide for water quality treatment (for example, Alt. 2B). In addition, an assessment of the existing roadway under existing conditions was prepared, as well as an assessment of the existing roadway, unmodified, under the Modified Water Deliveries project water elevation conditions.

Three additional alternatives were defined for analysis, and are the subject of this Addendum. Those three alternatives are:

a. Alternative 6: Existing Alignment with Raised Profile, Four-Mile Bridge and 8 New Box Culverts.

b. Alternative 7: Existing Alignment with Raised Profile and 3,000-foot Bridge

c. Alternative 8: Existing Alignment with Raised Profile and Additional Culverts.

Cost estimates were developed for each alternative and variation, using the USACE MCACES package and the FDOT historical bid price database. The base cost estimate considered typical construction schedules, alternative-specific construction phasing, standard siltation curtain provisions, and other assumptions. The costs should be considered conceptual in nature, and only those special requirements or provisions noted are specifically included in base cost estimates (thus items such as lighting, rest areas, observation points, motorist call boxes are not included). Utility adjustments are Estimates follow standard MCACES practice for additives and include a contingency factor as directed. Construction activity may be affected seasonally by habitat considerations for certain species; any resulting restrictions and their effect on construction costs are not known at this time.

5. Alternative 6: Existing Alignment Raised Profile with 4-Mile Structure

A. Description

This alternative is a hybrid between Alternative 5: New Alignment on Structure for the entire 11-mile project limits and Alternative 2: Existing Alignment with Raised Profile and Four New Bridges. It is defined as modifying the existing Tamiami Trail embankment with a modified profile and typical section and the construction of a bridge similar to that for Alternative 5 with a length of approximately 4 miles to convey Modified Water Deliveries project flows from the L-29 Borrow Canal to Everglades National Park. The bridge will begin at the Blue Shanty Canal about 3 miles from the west end of the corridor, and will extend just to the east of the Cooperstown Canal. This alternative also includes 8 new box culverts.

As defined, this alternative does not include specific features to accommodate wildlife. Consideration may be given to including various wildlife features as part of this alternative (See Plates WL-1 through 3). To maintain a common basis of comparison between alternatives, these features are discussed separately in Paragraphs 21 and 22. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the 4-mile bridge. The underpasses consist of an approximately 50-foot long concrete slab bridge placed in the highway alignment. The land bridges consist of a 24-foot wide concrete bridge with 2 feet of soil spread on its surface for vegetation to grow. Fencing will be needed on each side of the 2 underpasses to funnel wildlife to the underpasses.

The existing Tamiami Trail embankment profile and typical section will be modified for approximately 3 miles at the western end of the project and approximately 4 miles at the eastern end of the project. The centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Borrow Canal. Eight box culverts will be strategically placed in areas where the natural slough crosses Tamiami Trail to enhance the natural, historic sheet flow. The typical section, plan views of a portion of this alternative, and construction phasing are depicted in Plates A6-1 through A6-13.

For the condition where there would be no water quality treatment, the centerline of this alignment will fall very close to the centerline of the existing facility. For the condition where there would be water quality treatment, the centerline of the alignment will fall approximately 27 feet to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor. As part of this option, the existing drainage culverts will be retained and extended 55 feet to connect through the widened typical section.

The bridge portion of this alternative is defined as reconstruction of approximately 4 miles of the Tamiami Trail alignment as an elevated structure. The alignment would be positioned to minimize impact and construction cost, and to facilitate maintenance of traffic during construction. The profile would be established per the applicable drift, maintenance and navigation bridge clearance. This alternative requires only a modest alignment transition at either end of the bridge.

The existing Tamiami Trail embankment would need to be breached at four evenly spaced locations along the 4-mile bridge totaling about 1,500 feet in length. The bridge typical section would be standard the entire length, with two travel lanes of 12 feet, two shoulders of 8 feet, and outside barrier shapes. Exceptions would occur where a surface connection for access or other reasons might be required; at these locations turning lanes might be needed. The typical section is depicted in Plates A6-2 and A6-3 and plan views of key locations along this alternative are depicted in Plates A6-4, A6-5, and A6-6. Construction phasing is shown on Plates A6-7 through A6-10, bridge details on Plate A6-11, and pavement typical sections on Plates A6-12 and A6-13.

For the instance without water quality treatment, the new bridge deck would be equipped with drain scuppers that would discharge directly to the area below. For the instance with water quality treatment, piping would convey runoff to dry retention facilities constructed on adjacent segments of the abandoned existing roadway embankment. These swales would be approximately 600 feet long and spaced at _ mile intervals, such that there would be approximately 7 of them adjacent to the

bridge. These would require maintenance to be provided by workers using lightweight equipment transported by boat.

B. Typical Sections and Pavement Design

- Roadway Typical Section

This typical section consists of two 12-foot wide travel lanes, and 8-foot wide shoulders on each side of the roadway. There is guardrail located at the outside edges of these shoulders.

- Bridge Typical Section

The bridge typical section shall provide two 12-foot travel lanes with 8-foot shoulders and outside barriers.

- Pavement Design: Alternative 6A – Without Water Quality Treatment

This alternative is upgrading the existing roadway to accommodate a Design High Water elevation of 9.3 feet and traffic for 50 years. This is achieved through placing a thick structural overlay. The upgrade needs to consider the impact of the design high water elevation, overtopping, and grade variations.

The recommended approach is to leave the existing asphalt pavement in-place as a construction platform and serve as a black base. The low areas shall all be leveled to minimum elevation of 11.0 feet throughout the project. Then a 6-inch asphalt overlay will be placed. The calculations are summarized below.

First, by considering the project a maintenance effort, thick structural overlays can be used and reconstruction is not necessary. For the existing roadway, using the average elevation of 11 feet, with a 6-inch asphalt thickness, there is slightly more than 1 foot of clearance to the 9.3-foot design high water elevation. In areas where the roadway profiles dip as low as 10 feet, the bottom of the existing 6 inch asphalt is essentially at the Design High Water level.

A reasonable approach is that after leveling to elevation of 11.0 feet with asphalt overbuild, the top 6 inches below elevation 11.0 feet be considered black base. This is quite reasonable because elevation 11.0 feet provides for a foot of clearance from the bottom of the declared black base (elevation 10.5 feet) using either existing granular embankment or asphalt overbuild. In many cases, the asphalt overbuild will be 12 inches thick, providing a total asphalt thickness of 18 inches for over a mile; note this is even before the structural overlay is placed

Recall that the FWD testing conservatively estimated the embankment modulus at 5,000 psi (the Florida DOT method would predict it at 15,000 psi), and that to account somewhat for the higher water level, the modulus was reduced to 4,000 psi. Using the 50-year projected traffic and an embankment resilient modulus of 4,000 psi, the required structural number is 6.17. Using the effective AASHTO structural number of the existing pavement structure, SNeff, of 3.5, a 6-inch asphalt overlay provides a structural number of 6.14. This is slightly less than the 6.17 inches required, which equates to 0.15 inches of asphalt. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. Plate A6-12 shows the schematic of the pavement section.

A key issue is that the roadway will be close to the Design High Water table, and that more frequent resurfacings are anticipated than for a normal roadway. This is in part due to potential localized failures and some settlement of the muck. The geotechnical sub-consultant did a simple settlement calculation of placing a foot of asphalt on top of the existing pavement. The buoyant force of the raised water elevation almost counteracts the weight of the additional asphalt. However, in areas where more than 1 inch of asphalt is placed, settlements are expected. Similarly, if the water elevation seldom reaches 9.3 feet, then there is less buoyant force and additional settlement is expected.

Considering that the existing roadway was resurfaced 7 years ago, and by its cracking condition of 6 is technically ready for a resurfacing, a 7-year resurfacing interval for this option appears warranted. This is considerably more frequent than a 10 to 15 year interval common in Florida; however, the Tamiami Trail is surrounded by the Everglades and exposed to water throughout the year. The recommended pavement section follows:

Alternative 6A - Roadway Section - Without Water Quality Treatment

Proposed centerline elevation = 11.5 feet
_ inch friction course
6 inch structural asphalt
0-12 inch asphalt overbuild
Existing 6 inch asphalt pavement
Existing embankment

- Pavement Design: Alternative 6B - With Water Quality Treatment

This alternative requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway (Refer to Plate A6-13). After

designing the necessary slopes for the treatment facilities, it became obvious that one-half of the roadway would be on new embankment and one-half on the existing embankment. This is an undesirable condition because of differential settlement across the joint. The differential would cause a safety threat to motorists and be a persistent maintenance concern. Therefore, the entire existing embankment is recommend to be removed down to the bedrock, and any additional footprint needed also have the muck removed to the bedrock. A new embankment of A-1 or A-3 material needs to be built.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness is designed using Florida DOT procedures. The design will be most economical if conventional granular materials can be used with the 2-foot separation from the Design High Water elevation of 9.3 feet. Therefore, to provide sufficient clearance to accommodate fluctuations in the water elevation, a new top of asphalt centerline elevation of 14 feet is recommended.

For 50-year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material, which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The recommended pavement section is as follows:

Alternative 6B – Roadway Section With Water Quality Treatment

Proposed centerline elevation = 14 feet
_ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment
4 inch drainage layer
A-1 or A-3 embankment

To illustrate the clearances, if the top of pavement is at elevation 14 feet, the bottom of the limerock base is at elevation 12.75 feet, providing about 3.5 feet of clearance

above the Design High Water elevation of 9.3 feet. This exceeds the 2-foot minimum.

As an added precaution against capillary rise from the water table, a 4-inch granular drainage layer is placed beneath the LBR 40 subbase. The drainage layer will be designated to have no material smaller than the No. 8 sieve, which will inhibit the capillary rise into the base layers and still have construction stability. The drainage layer will need to be wrapped in filter fabric to prevent intrusion of the embankment soils into the layer.

The periodic resurfacing interval recommended for this alternative is 12 years. This is the lower end of the typical 10 to 15 year interval in Florida. This is because even with the precautions of the drainage layer and additional high water clearance, the roadway is still in the Everglades and has ample access to water and maybe even unforeseen high water events.

C. Plan and Profile

The proposed profile is to be raised to provide a set clearance from the controlled high water elevation to the bottom of the proposed roadway subgrade. The set clearance is to meet FDOT design criteria, as well as drainage criteria. The proposed elevation at the crown of the roadway is 11.5 feet for the option without water quality treatment, and 14.0 feet for the option with water quality treatment. The profile will be raised significantly at the proposed bridge and will be established per applicable drift, maintenance and navigation bridge clearances, while minimizing humps in the profile.

D. Structures

Roadway Bridges

The proposed 43'-1" wide bridge typical section provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. A proposed 35'-1" wide bridge typical section applies to the access bridge to the Airboat Association of Florida site and provides sufficient deck area for two 12-foot wide travel lanes, and 4 foot shoulders on the both sides of the travel lanes. Refer to Plate A6-11 for a description of the bridge length. Refer to Plate A6-5 for a description of the access bridge to the Airport Association of Florida site.

Several superstructure and substructure alternatives were evaluated to determine the most cost effective bridge structure. These systems include:

Superstructure Alternatives	Substructure Alternatives
Transversely Post-Tensioned Slab Units FDOT Precast Prestressed Double Tee System AASHTO Beams Types II, III, IV, V, & VI with Cast-in-Place Concrete Deck Florida Bulb Tees 72 and 78 with Cast-in-Place Concrete Deck	18 and 24 inch square Prestressed Concrete Piles (with pre-drilling) 3 foot diameter Drilled Shafts

The most cost-effective bridge structural system for the bridge uses AASHTO Type V Beams with a composite cast-in-place concrete deck. The superstructure is supported on pile bents using two 3-foot diameter drilled shafts.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructability of the bridges for this alternative. Installation of the drilled shafts and erection of the precast beams for the bridges over the L-29 Borrow Canal will most likely be performed from barge-mounted cranes. Crane size and lifting capability may be limited based on the size of barge that can be transported to and placed within the canal.

The minimum offset of the centerline of the bridge from the centerline of the roadway was established as 36 feet to allow a minimum buffer area of 5 feet from the temporary barrier to the edge of bridge, to allow the construction of temporary pavement without impacting the wetlands (see Maintenance of Traffic section), and to allow a minimum of 50 feet of canal width for barge operations. This offset could be increased by 10 feet to allow for a pullout lane for precast beam delivery. This offset cannot by increased sufficiently to allow for crane placement on the south bank of the canal without either filing part of the canal or impacting the wetlands by shifting the traffic farther south.

- Airboat Association Access Bridge

The proposed typical section for this 35’-1’’ wide bridge provides sufficient deck area for two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. This bridge is identical to the Bridge 4 identified in Alternative 3. Refer to Plate A3-13a for a description of the bridge length, the canal clearances and hydraulic opening.

The proposed bridge structural system of an AASHTO Type II superstructure with cast-in-place concrete deck supported on pile bents using 18-inch square prestressed concrete piles. Standard construction procedures can be utilized for this bridge with little impact to existing traffic.

Box Culverts

Alternative 6 incorporates the use of eight box culverts to convey water. The culverts are to be 5 feet high and 10 feet wide inside dimensions. It is anticipated precast concrete sections will be used, with a nominal wall thickness of 1 foot. The Corps of Engineers has requested the invert elevations be at 3 feet. Referring to Plate BC-1, the elevation of the existing bedrock is nominally at 3 feet; therefore, shallow excavation of the bedrock will be required.

The method of excavating the bedrock is proposed to be by breaking with air-hammers mounted to large track hoes, and then excavating. Note that blasting is not permissible. The bedrock excavation depth is recommended to be 18 inches. This will allow for a nominal 6 inch bedding layer of a stiff flowable fill (sand-cement mixture) to be placed as a mud slab foundation for the culverts. It will also fill any exposed voids in the bedrock, preventing piping of embankment soils into the exposed voids. The flowable fill mixture will have a maximum compressive strength of 300 psi.

For the alternatives without water quality treatment, the existing roadway embankment will remain. The embankment and bedrock will be excavated and the box culverts set. The backfill will be flowable fill beneath the roadway and shoulders, with the area contained by A-3 fill outside the shoulders. For the alternatives with water quality treatment, the box culvert may be installed either before or after embankment construction. Plate BC-1 shows the typical installation.

Two installation schemes have been identified for the new box culverts for the "without water quality treatment" condition. The first option entails a detour to be built to the south in a fashion similar to that considered for short bridges (See Plate A8-6). This option has the disadvantage of a relatively large detour configuration for a small work area, and related cost and temporary environmental impacts to adjacent wetlands.

The second option involves shifting traffic within the existing roadway and shoulder area to the north excavating and constructing a gabion wall, installing half of the culvert, restoring the embankment and roadway base and pavement, then repeating the operation on the north side. This approach will require about 12 feet of temporary encroachment to the south for additional fill to facilitate a two-phase culvert installation while maintaining two-way traffic flow. This option is approximately 40% of the cost of the first option.

For the alignment configuration with water quality treatment, the roadway section is shifted so that there is no real maintenance of traffic issue for the box culvert installation.

Wildlife Features

Wildlife road undercrossings and canal crossings are not included in this alternative as defined and costed – they are considered an optional feature. However, the structural aspects of these crossings is provided herein for reference.

- Wildlife Roadway Undercrossing Bridges

The proposed typical section for this 43'-1'' wide bridge provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes.

Refer to Plate WL-1 for a description of the bridge length and the associated opening for wildlife to pass under the bridge.

The superstructure and substructure shown for the wildlife undercrossing is based on other wildlife undercrossing bridges of similar configuration developed for various FDOT Construction Projects. From this information, the proposed bridge structural system is assumed to be a cast-in-place flat slab supported on pile bents using 18-inch square prestressed concrete piles installed and driven in holes predrilled to El. –10.00 into the limerock. The abutments form a vertical wall with precast panels behind the piles retaining the embankment.

Methods for placement of cranes and delivery of material, such as piles, precast beams, and concrete is similar to other mainline bridge replacement alternatives described elsewhere in the report.

- Wildlife Canal Crossing

The proposed typical section for this 27'-1'' wide bridge provides sufficient deck area for a 14-foot wide wildlife passage bounded by a 5-foot landscape buffer on each side. Refer to Plate WL-3 for a description of the bridge length, the canal clearances and hydraulic opening. Standard traffic railing barrier is proposed to retain the natural earth on the bridge, and provides a similar exterior look as all the other vehicular traffic bridges.

The proposed bridge structural system of an AASHTO Type II superstructure with cast-in-place concrete deck supported on pile bents using 18-inch square prestressed concrete piles. Standard construction procedures can be utilized for this bridge with little impact to existing traffic.

Maintenance of traffic requirements are discussed under Subparagraph H.

E. Drainage

Two drainage alternatives are being considered for the proposed reconstruction. Due to potential wetland impacts resulting from the construction of water quality treatment facilities, a detailed analysis has been performed, estimating wetland impacts both with and without water quality treatment facilities. In doing so, the permitting agencies will have a chance to determine whether wetland impacts offset the required water quality treatment.

If water quality treatment of stormwater runoff from the new structure is not included, runoff from the bridge would be discharged through scuppers at regular spacings on both sides of the bridge deck. The other variation with water quality treatment requires catchment of the runoff through a piping system to a system of dry linear retention facilities constructed on the remaining existing road embankment. The individual swales would be approximately 600 feet long and spaced at _ mile intervals. The culverts under the existing roadway embankment would be unaffected by new construction except for breaches for water flow, and would be left in place.

If water quality treatment requirements are met in the roadway portion of the project, dry linear retention facilities will be constructed adjacent to the proposed roadway. The invert elevations are set 1 foot above the new high control elevation of Canal L-29, which is 8.5 feet. As such the treatment facilities will have a control elevation of 9.5 feet and an overall depth of 1 foot. Based on water quality requirements by FDEP (including OFW considerations), the depth of the water quality volume provided is estimated at 0.5 feet deep.

Regardless of the stormwater treatment scenarios, the existing system of culverts will not be replaced for the reconstruction alternative. The MWD project did not include the culverts to pass the required discharge south into the park. For the roadway portion of this alternative, both options encroach on the south headwalls of the culverts. Consequently, the south end of the culverts will be plugged with flowable fill to prevent water from flowing south towards the new embankment.

F. Utilities

There are existing utilities within the corridor that will be affected by the new construction. There are buried telephone facilities running behind the guardrail on the north and south sides of the roadway. There is also a 23 kv overhead electric line running along the south side; located about 100 feet south of the existing guardrail. Just behind the guardrail on the north side of the roadway is an additional buried telephone facility.

All utilities within the proposed typical section will need to be relocated. Utility relocations will be coordinated with each utility owner. As the underground utilities appear to fall within the right-of-way, their relocation costs are not included in the cost estimates.

G. Environmental Factors

As the roadway portion of this alternative without water quality treatment preserves the existing facility, it has limited environmental impacts and there is limited permanent encroachment into Everglades National Park. As much of the footprint of this alternative with water quality treatment is located to the south of the existing facility, it has significant environmental impacts to Everglades National Park.

The alignment without water quality treatment does not encroach beyond the existing footprint to the south with the exception of box culvert placement, while the option with water quality treatment encroaches approximately 51 feet to the south. These permanent encroachments are 0.3 acres for Alt. 6A and 50.3 acres for Alt.6B, respectively.

The bridge alignment has limited environmental impacts. These include the temporary wetland impacts of the two detour roads at either end of the bridge, which will impact wetlands to the south, an area of 3.5 acres for the two transitions. These areas would be restored after construction of the transitions is completed. There is no permanent encroachment into Everglades National Park, or the wood stork rookery. There are 6.7 acres of temporary impact for both Altenatives 6A and 6B.

H. Maintenance of Traffic During Construction

Alternative 6A – Roadway Portion

Traffic is to be maintained as it exists today. The overlay of the existing roadway will be accomplished using a moving operation. Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

Alternative 6B – Roadway Portion

Temporary barricades spaced every 50 feet are placed at the north edge of the westbound travel lane line. In 1/4-mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the north, utilizing the new pavement. A ten-foot wide strip of temporary pavement is placed south of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed one foot north of the south edge of the temporary pavement.

Unsuitable material is excavated and embankment is placed and compacted along the proposed alignment. The southern guardrail, eastbound shoulder and both travel lanes are constructed. A temporary barrier wall is placed adjacent to the westbound travel lane and traffic is shifted to the new pavement. The westbound shoulder and guardrail are constructed and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time basis at the work site.

Bridge Portion

In order to construct this alignment, the existing roadway will need to be shifted to the south. This shift will prevent any traffic flow to be allowed underneath the proposed structure. Once temporary pavement is constructed on the south shoulder, traffic can be shifted out from under the proposed alignment. Construction staging will be done from a barge in the L-29 Borrow Canal, minimizing the impact to both the wetlands and the traffic. Refer to Paragraph D above for additional discussion.

Temporary barricades spaced every 50 feet are to be placed at the south edge of the eastbound travel lane line. In _ mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the south, utilizing the new pavement. A 10-foot wide strip of temporary pavement is placed north of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed at the north south edge of the temporary pavement. The bridge is then constructed.

A temporary roadway is constructed south of the existing alignment in the transition areas. Once the temporary roadway is completed, traffic is shifted onto it and the

transitions are constructed to the new bridge. Traffic is then shifted to the new alignment, and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

Wildlife Crossings

Wildlife crossings are not included in this alternative as defined and costed – they are considered an optional feature. However, the construction of these crossings is provided herein for reference. There are three options for the horizontal layout of the proposed wildlife bridges. Of the three, the temporary detour option similar to that used for other short mainline bridges on other alternatives was selected because it maintains a straight roadway alignment and reduces permanent wetland encroachment. This option is more costly since it requires the construction of a temporary roadway, reconstruction of the existing roadway on the approach to the new bridge, and removal of the temporary roadway.

Offset Final Alignment to the South

The first option is permanently offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway (±10.4 feet) to the proposed bridge deck (±17 feet), shifting the alignment to locate the structure outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they can be opened up to traffic flow, and the existing roadway will be removed at the bridge opening. These breaches will allow for the flow of water under the bridge. Because this option involves permanent wetland encroachment and introduces undesirable roadway geometry, it is not considered further.

Offset Temporary Detour to South

The second option involves the construction of a temporary roadway that is offset to the south from the existing roadway. Once this detour is built, traffic is then shifted onto this temporary alignment, and the new structure and its approaches are constructed along the existing alignment. The shift in traffic will allow for the de-mucking operation that will be required along the new raised profile.

Offset Temporary Detour North into L-29 Canal

The detour on the north side of the existing roadway for the construction of 2 wildlife crossings requires two 1,200-foot long approach bridges and a 1,050-foot long temporary steel truss bridge (Bailey bridge) per each bridge site. The width of the temporary bridge is 32 feet, which provides two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. The gap between the existing roadway and the detour is kept to minimum (10 feet) to minimize the length and width of approach bridges. The required width of the approach bridges is 42 feet.

The construction method and the superstructure system proposed for the permanent bridges are dictated by limited construction area available. Post-tensioned precast slab units with top-down construction are proposed as a viable alternative. The optimum span length for this type of superstructure was determined to be around 30 feet. The most cost effective substructure system for these bridges is 18-inch square prestressed concrete piles.

The cost analysis is based on the construction of one bridge at a time and reuse of superstructure of temporary and approach bridges at other bridge location.

- Approach Bridges

One line of 36-inch diameter drilled shafts at every 30 feet is proposed in the L-29 Canal to minimize the interruption of flow with another line of 36-inch diameter drilled shafts along the bank. This type of substructure configuration will require a superstructure system spanning along the width of the bridge. The best-suited superstructure system for this bridge is post-tensioned precast slab units. Precast slab units will be reused at other bridge sites.

- Temporary Bridge

The proposed temporary bridge is a 1,050-foot long, two lane Bailey bridge with 30-foot spans. The bridge will be supported on piers with two 36-inch diameter drilled shafts. Drilled shafts in the L-29 Canal will line up with the drilled shafts of the approach bridges to minimize the interruption of flow. Temporary bridges will be reused at other bridge sites.

I. Construction and Life Cycle Costs

The cost of this alternative without water quality treatment is $72,877,979 and with water quality treatment is $81,369,677. Most of the cost is related to the roadway elements, and is slightly greater with water quality control because of the additional fill required. These costs do not include any optional wildlife features.

Alternative 6	
Alt. 6A - Without Water Quality Control	
Roadway	**$13,432,658**
Bridge	**$48,432,321**
Box Culverts	**$11,013,000**
Total	**$72,877,979**
Alt. 6B - With Water Quality Control	
Roadway	**$32,279,460**
Bridge	**$48,432,321**
Box Culverts	**$657,896**
Total	**$81,369,677**

As is discussed in Paragraph 21.A, for Alternative 6A the cost of box culverts could be reduced about 60% by using the alternate construction method mostly within the existing embankment (about $6 million in savings), reducing the cost of Alternative 6A to about $66.8 million.

The life cycle costs for this alternative were developed for two cases: for the roadway alone, and for the total project. For the case without water quality treatment, pavement life cycle costs were calculated at $12,235,870 while the total project life cycle costs were estimated to be $77,994,054. For the case with water quality treatment, pavement life cycle costs were calculated at $18,942,025 while the total project life cycle costs were estimated to be $83,245,822. Paragraph 8 later in this section discusses the life cycle cost analysis.

J. Other Aspects

There are existing features that must remain undisturbed. The Flight 592 Memorial is located north of the L-29 borrow canal near the western limits of the project. This will not be impacted with this alternative. Access will remain at the S-333, S-334, and S-336. Connecting roads will be provided for access to the Airboat Association. Access to the Osceola Camp will be by way of a connecting road from the west. At these locations, turn lanes may be needed.

6. Alternative 7: Raised Profile with 3000-foot Structure

A. Description

This alternative is a hybrid between the New Alignment on Structure for the entire 11-mile project limits (Alternative 5) and the existing alignment with Raised Profile (Alternative 2). It is defined as modifying the existing Tamiami Trail profile and typical section at the beginning and end of the study segment, and the construction

of a bridge with a span of approximately 3,000 feet to convey Modified Water Deliveries project flows from the L-29 Borrow Canal to Everglades National Park. The bridge will begin approximately 1 mile from the west end of the corridor.

As defined, this alternative does not include specific features to accommodate wildlife. Consideration may be given to including various wildlife features as part of this alternative (See Plates WL-1 through 3). To maintain a common basis of comparison between alternatives, these features are discussed separately in Paragraphs 21 and 22. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the 4-mile bridge. The underpasses consist of an approximately 50-foot long concrete slab bridge placed in the highway alignment. The land bridges consist of a 24-foot wide concrete bridge with 2 feet of soil spread on its surface for vegetation to grow. Fencing will be needed on each side of the 2 underpasses to funnel wildlife to the underpasses.

The existing Tamiami Trail profile and typical section will be modified for approximately 1 mile at the western end of the project and approximately 9.4 miles to the east of the bridge. The centerline of the roadway may be adjusted southward to avoid encroachment into the L-29 Borrow Canal. The typical section, plan views of a portion of this alternative, and construction phasing are depicted in Plates A7-1 through A7-12. Existing box culverts will be retained for the Without Water Quality Treatment option, and will be plugged in the With Water Quality Treatment option.

For the condition where there would be no water quality treatment, the centerline of this alignment will fall very close to the centerline of the existing facility. For the condition where there would be water quality treatment, the centerline of the alignment will fall approximately 27 feet to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

The bridge portion of this alternative is defined as reconstruction of approximately 3,000 feet of the Tamiami Trail alignment as an elevated structure. The alignment would be positioned to minimize impact and construction cost, and to facilitate maintenance of traffic during construction. The profile would be established per the applicable drift, maintenance and navigation bridge clearance. This alternative requires only a modest alignment transition at either end of the bridge.

The existing Tamiami Trail embankment will be removed adjacent to the 3,000-foot long bridge. The bridge typical section would be standard the entire length, with two travel lanes of 12 feet, two shoulders of 8 feet, and outside barrier shapes. Exceptions would occur where a surface connection for access or other reasons

might be required; at these locations turning lanes might be needed. The typical section is depicted in Plates A7-2 and A7-3 and plan views of key locations along this alternative are depicted in Plates A7-4 and A7-5. Construction phasing is shown on Plates A7-6 through A7-9, bridge details on Plate A7-10, and pavement typical sections on Plates A7-11 and A7-12.

For the instance without water quality treatment, the new bridge deck would be equipped with drain scuppers that would discharge directly to the area below. For the instance with water quality treatment, piping would convey runoff to dry retention facilities constructed in the remaining existing roadway embankment. These facilities would be approximately 600 feet long and spaced at _ mile intervals, such that there would be approximately 2 of them adjacent to the bridge. These would require maintenance to be provided by workers using lightweight equipment transported by boat. By definition for this alternative, 3,000 feet of existing roadway embankment adjacent to the bridge will be breached and removed for hydraulic flow.

B. Typical Sections and Pavement Design

- Roadway Typical Section

This typical section consists of two 12-foot wide travel lanes, and 8-foot wide shoulders on each side of the roadway. Five feet of this shoulder will be paved. There is guardrail located at the outside edges of these shoulders.

- Bridge Typical Section

The bridge typical section shall provide two 12-foot travel lanes with 8-foot shoulders and outside barriers.

- Pavement Design: Alternative 7A – Without Water Quality Treatment

This alternative is upgrading the existing roadway to accommodate a Design High Water elevation of 9.3 feet and traffic for 50 years. This is achieved through placing a thick structural overlay. The upgrade needs to consider the impact of the design high water elevation, overtopping, and grade variations.

The recommended approach is to leave the existing asphalt pavement in-place as a construction platform and serve as a black base. The low areas shall all be leveled to minimum elevation of 11.0 feet throughout the project. Then a 6-inch asphalt overlay will be placed. The calculations summarized below.

First, by considering the project a maintenance effort, thick structural overlays can be used and reconstruction is not necessary. For the existing roadway, using the average elevation of 11 feet, with a 6-inch asphalt thickness, there is slightly more

than 1 foot of clearance to the 9.3-foot design high water elevation. In areas where the roadway profiles dip as low as 10 feet, the bottom of the existing 6 inch asphalt is essentially at the Design High Water level.
A reasonable approach is that after leveling to elevation of 11.0 feet with asphalt overbuild, the top 6 inches below elevation 11.0 feet be considered black base. This is quite reasonable because elevation 11.0 feet provides for a foot of clearance from the bottom of the declared black base (elevation 10.5 feet) using either existing granular embankment or asphalt overbuild. In many cases, the asphalt overbuild will be 12 inches thick, providing a total asphalt thickness of 18 inches for over a mile; note this is even before the structural overlay is placed.

Recall that the FWD testing conservatively estimated the embankment modulus at 5,000 psi (the Florida DOT method would predict it at 15,000 psi), and that to account somewhat for the higher water level, the modulus was reduced to 4,000 psi. Using the 50-year projected traffic and an embankment resilient modulus of 4,000 psi, the required structural number is 6.17. Using the effective AASHTO structural number of the existing pavement structure, SNeff, of 3.5, a 6-inch asphalt overlay provides a structural number of 6.14. This is slightly less than the 6.17 inches required, which equates to 0.15 inches of asphalt. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. Plate A2-11 shows the schematic of the pavement section.

A key issue is that the roadway will be close to the Design High Water table, and that more frequent resurfacings are anticipated than a normal roadway. This is in part due to potential localized failures and some settlement of the muck. The geotechnical sub-consultant did a simple settlement calculation of placing a foot of asphalt on top of the existing pavement. The buoyant force of the raised water elevation almost counteracts the weight of the additional asphalt. However, in areas where more than 1 inches of asphalt are placed, settlements are expected. Similarly, if the water elevation seldom reaches 9.3 feet, then there is less buoyant force and additional settlement is expected.

Considering that the existing roadway was resurfaced 7 years ago, and by its cracking condition of 6 is technically ready for a resurfacing, a 7-year resurfacing interval for this option appears warranted. This is considerably more frequent than a 10 to 15 year interval common in Florida; however, the Tamiami Trail is surrounded by the Everglades and exposed to water throughout the year. The recommended pavement section follows:

Alternative 7A - Roadway Section - Without Water Quality Treatment

Proposed centerline elevation = 11.5 feet
_ inch friction course
6 inch structural asphalt
0-12 inch asphalt overbuild
Existing 6 inch asphalt pavement
Existing embankment

- Pavement Design: Alternative 7B - With Water Quality Treatment

This alternative requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway (Refer to Plate A7-12). After designing the necessary slopes for the treatment facilities, it became obvious that one-half of the roadway would be on new embankment and one-half on the existing embankment. This is an undesirable condition because of differential settlement across the joint. The differential would cause a safety threat to motorists and be a persistent maintenance concern. Therefore, the entire existing embankment is recommend to be removed down to the bedrock, and any additional footprint needed also have the muck removed to the bedrock. A new embankment of A-1 or A-3 material needs to be built.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness is designed using Florida DOT procedures. The design will be most economical if conventional granular materials can be used with the 2-foot separation from the Design High Water elevation of 9.3 feet. Therefore, to provide sufficient clearance to accommodate fluctuations in the water elevation, a new top of asphalt centerline elevation of 14 feet is recommended.

For 50-year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material, which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional

thickness deemed necessary can be added with the resurfacings and considered a staged construction. The recommended pavement section is as follows:

Alternative 7B – Roadway Section With Water Quality Treatment

Proposed centerline elevation = 14 feet
_ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment
4 inch drainage layer
A-1 or A-3 embankment

To illustrate the clearances, if the top of pavement is at elevation 14 feet, the bottom of the limerock base is at elevation 12.75 feet, providing about 3.5 feet of clearance above the Design High Water elevation of 9.3 feet. This exceeds the 2-foot minimum.

As an added precaution against capillary rise from the water table, a 4-inch granular drainage layer is placed beneath the LBR 40 subbase. The drainage layer will be designated to have no material smaller than the No. 8 sieve, which will inhibit the capillary rise into the base layers and still have construction stability. The drainage layer will need to be wrapped in filter fabric to prevent intrusion of the embankment soils into the layer.

The periodic resurfacing interval recommended for this alternative is 12 years. This is the lower end of the typical 10 to 15 year interval in Florida. This is because even with the precautions of the drainage layer and additional high water clearance, the roadway is still in the Everglades and has ample access to water and maybe even unforeseen high water events.

C. Plan and Profile

The proposed profile is to be raised to provide a set clearance from the controlled high water elevation to the bottom of the proposed roadway subgrade. The set clearance is to meet FDOT design criteria, as well as drainage criteria. The proposed elevation at the crown of the roadway is 11.5 feet for the option without water quality treatment, and 14.0 feet for the option with water quality treatment. The profile will be raised significantly at the proposed bridge and will be established

per applicable drift, maintenance and navigation bridge clearances, while minimizing humps in the profile.

D. Structures

Roadway Bridges

The proposed 43'-1" wide bridge typical section provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. Several superstructure and substructure alternatives were evaluated to determine the most cost effective bridge structure. These systems include:

Superstructure Alternatives	Substructure Alternatives
Transversely Post-Tensioned Slab Units FDOT Precast Prestressed Double Tee System AASHTO Beams Types II, III, IV, V, & VI with Cast-in-Place Concrete Deck Florida Bulb Tees 72 and 78 with Cast-in-Place Concrete Deck	18 and 24 inch square Prestressed Concrete Piles (with pre-drilling) 3 foot diameter Drilled Shafts

The most cost-effective bridge structural system for the bridge uses AASHTO Type V Beams with a composite cast-in-place concrete deck. The superstructure is supported on pile bents using two 3-foot diameter drilled shafts.

Placement of cranes and delivery of material, such as piles, precast beams, and concrete were analyzed to ensure constructability of the bridges for this alternative. Installation of the drilled shafts and erection of the precast beams for the bridges over the L-29 Borrow Canal will most likely be performed from barge-mounted cranes. Crane size and lifting capability may be limited based on the size of barge that can be transported to and placed within the canal.

The minimum offset of the centerline of the bridge from the centerline of the roadway was established as 36 feet to allow a minimum buffer area of 5 feet from the temporary barrier to the edge of bridge, to allow the construction of temporary pavement without impacting the wetlands (see Maintenance of Traffic section), and to allow a minimum of 50 feet of canal width for barge operations. This offset could be increased by 10 feet to allow for a pullout lane for precast beam delivery. This

offset cannot by increased sufficiently to allow for crane placement on the south bank of the canal without either filing part of the canal or impacting the wetlands by shifting the traffic farther south.

Wildlife Features

Wildlife road undercrossings and canal crossings are not included in this alternative as defined and costed – they are considered an optional feature. However, the structural aspects of these crossings is provided herein for reference.

- Wildlife Roadway Undercrossing Bridges

The proposed typical section for this 43'-1'' wide bridge provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes.

Refer to Plate WL-1 for a description of the bridge length and the associated opening for wildlife to pass under the bridge.

The superstructure and substructure shown for the wildlife undercrossing is based on other wildlife undercrossing bridges of similar configuration developed for various FDOT Construction Projects. From this information, the proposed bridge structural system is assumed to be a cast-in-place flat slab supported on pile bents using 18-inch square prestressed concrete piles installed and driven in holes predrilled to El. –10.00 into the limerock. The abutments form a vertical wall with precast panels behind the piles retaining the embankment.

Methods for placement of cranes and delivery of material, such as piles, precast beams, and concrete is similar to other mainline bridge replacement alternatives described elsewhere in the report.

- Wildlife Canal Crossing

The proposed typical section for this 27'-1'' wide bridge provides sufficient deck area for a 14-foot wide wildlife passage bounded by a 5-foot landscape buffer on each side. Refer to Plate WL-3 for a description of the bridge length, the canal clearances and hydraulic opening. Standard traffic railing barrier is proposed to retain the natural earth on the bridge, and provides a similar exterior look as all the other vehicular traffic bridges.

The proposed bridge structural system of an AASHTO Type II superstructure with cast-in-place concrete deck supported on pile bents using 18-inch square prestressed concrete piles. Standard construction procedures can be utilized for this bridge with little impact to existing traffic.

Maintenance of traffic requirements are discussed under Subparagraph H.

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E. Drainage

Two drainage alternatives are being considered for the proposed reconstruction. Due to potential wetland impacts resulting from the construction of water quality treatment facilities, a detailed analysis has been performed, estimating wetland impacts both with and without water quality treatment facilities. In doing so, the permitting agencies will have a chance to determine whether wetland impacts offset the required water quality treatment.

If water quality treatment of stormwater runoff from the new structure is not included, runoff from the bridge would be discharged through scuppers at regular spacings on both sides of the bridge deck. The other variation with water quality treatment requires catchment of the runoff through a piping system to a system of dry linear retention facilities constructed on the remaining existing road embankment. The individual faciliities would be approximately 600 feet long and spaced at _ mile intervals. The culverts under the existing roadway embankment would be unaffected by new construction except for breaches for water flow, and would be left in place.

If water quality treatment requirements are met in the roadway portion of the project, dry linear retention facilities will be constructed adjacent to the proposed roadway. The invert elevations are set 1 foot above the new high control elevation of Canal L-29, which is 8.5 feet. As such the treatment facilities will have a control elevation of 9.5 feet and an overall depth of 1 foot. Based on water quality requirements by FDEP (including OFW considerations), the depth of the water quality volume provided is estimated at 0.5 feet deep.

Regardless of the stormwater treatment scenarios, the existing system of culverts will not be replaced for the reconstruction alternative. The MWD project did not include the culverts to pass the required discharge south into the park. For the roadway portion of this alternative, only the With Water Quality Treatment option will encroach on the south headwalls of the culverts. Consequently, the culverts will be plugged with flowable fill to prevent water from flowing south towards the new embankment.

F. Utilities

There are existing utilities within the corridor that will be affected by the new construction. There are buried telephone facilities running behind the guardrail on the north and south sides of the roadway. There is also a 23 kv overhead electric

line running along the south side; located about 100 feet south of the existing guardrail. Just behind the guardrail on the north side of the roadway is an additional buried telephone facility.

All utilities within the proposed typical section will need to be relocated. Utility relocations will be coordinated with each utility owner. As the underground utilities appear to fall within the right-of-way, their relocation costs are not included in the cost estimates.

G. Environmental Factors

As the roadway portion of this alternative without water quality treatment preserves the existing facility, it has limited environmental impacts. As much of the footprint of this alternative with water quality treatment is located to the south of the existing facility, it has significant environmental impacts on Everglades National Park.

The alignment without water quality treatment does not encroach beyond the existing footprint to the south, while the option with water quality treatment encroaches approximately 51 feet to the south. Whereas there is no permanent encroachment Alt. 7A, there is encroachment of 67.4 acres.

The bridge alignment has limited environmental impacts. These include the temporary wetland impacts of the two detour roads at either end of the bridge, which will impact wetlands to the south, an area of 3.5 acres for the two transitions. These areas would be restored after construction of the transitions is completed. There is no permanent encroachment into Everglades National Park or the wood stork rookery.

H. Maintenance of Traffic During Construction

Alternative 7A – Roadway Portion

Traffic is to be maintained as it exists today. The overlay of the existing roadway will be accomplished using a moving operation. Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

Alternative 7B – Roadway Portion

Temporary barricades spaced every 50 feet are placed at the north edge of the westbound travel lane line. In 1/4-mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the north, utilizing the new pavement. A ten-foot wide strip of temporary pavement is placed south of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed one foot north of the south edge of the temporary pavement.

Unsuitable material is excavated and embankment is placed and compacted along the proposed alignment. The southern guardrail, eastbound shoulder and both travel lanes are constructed. A temporary barrier wall is placed adjacent to the westbound travel lane and traffic is shifted to the new pavement. The westbound shoulder and guardrail are constructed and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time basis at the work site.

Bridge Portion

In order to construct this alignment, the existing roadway will need to be shifted to the south. This shift will prevent any traffic flow to be allowed underneath the proposed structure. Once temporary pavement is constructed on the south shoulder, traffic can be shifted out from under the proposed alignment. Construction staging will be done from a barge in the L-29 Borrow Canal, minimizing the impact to both the wetlands and the traffic. Refer to Paragraph D above for additional discussion.

Temporary barricades spaced every 50 feet are to be placed at the south edge of the eastbound travel lane line. In _ mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the south, utilizing the new pavement. A 10-foot wide strip of temporary pavement is placed north of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed at the north south edge of the temporary pavement. The bridge is then constructed.

A temporary roadway is constructed south of the existing alignment in the transition areas. Once the temporary roadway is completed, traffic is shifted onto it and the transitions are constructed to the new bridge. Traffic is then shifted to the new alignment, and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

Wildlife Crossings

Wildlife crossings are not included in this alternative as defined and costed – they are considered an optional feature. However, the construction of these crossings is provided herein for reference. There are three options for the horizontal layout of the proposed wildlife bridges. Of the three, the temporary detour option similar to that used for other short mainline bridges on other alternatives was selected because it maintains a straight roadway alignment and reduces permanent wetland encroachment. This option is more costly since it requires the construction of a temporary roadway, reconstruction of the existing roadway on the approach to the new bridge, and removal of the temporary roadway.

Offset Final Alignment to the South

The first option is permanently offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway (±10.4 feet) to the proposed bridge deck (±17 feet), shifting the alignment to locate the structure outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they can be opened up to traffic flow, and the existing roadway will be removed at the bridge opening. These breaches will allow for the flow of water under the bridge. Because this option involves permanent wetland encroachment and introduces undesirable roadway geometry, it is not considered further.

Offset Temporary Detour to South

The second option involves the construction of a temporary roadway that is offset to the south from the existing roadway. Once this detour is built, traffic is then shifted onto this temporary alignment, and the new structure and its approaches are constructed along the existing alignment. The shift in traffic will allow for the de-mucking operation that will be required along the new raised profile.

Offset Temporary Detour North into L-29 Canal

The detour on the north side of the existing roadway for the construction of 2 wildlife crossings requires two 1,200-foot long approach bridges and a 1,050-foot long temporary steel truss bridge (Bailey bridge) per each bridge site. The width of the temporary bridge is 32 feet, which provides two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. The gap between the existing roadway and the detour is kept to minimum (10 feet) to minimize the length and width of approach bridges. The required width of the approach bridges is 42 feet.

The construction method and the superstructure system proposed for the permanent bridges are dictated by limited construction area available. Post-tensioned precast slab units with top-down construction are proposed as a viable alternative. The optimum span length for this type of superstructure was determined to be around 30 feet. The most cost effective substructure system for these bridges is 18-inch square prestressed concrete piles.

The cost analysis is based on the construction of one bridge at a time and reuse of superstructure of temporary and approach bridges at other bridge location.

- Approach Bridges

One line of 36-inch diameter drilled shafts at every 30 feet is proposed in the L-29 Canal to minimize the interruption of flow with another line of 36-inch diameter drilled shafts along the bank. This type of substructure configuration will require a superstructure system spanning along the width of the bridge. The best-suited superstructure system for this bridge is post-tensioned precast slab units. Precast slab units will be reused at other bridge sites.

- Temporary Bridge

The proposed temporary bridge is a 1,050-foot long, two lane Bailey bridge with 30-foot spans. The bridge will be supported on piers with two 36-inch diameter drilled shafts. Drilled shafts in the L-29 Canal will line up with the drilled shafts of the approach bridges to minimize the interruption of flow. Temporary bridges will be reused at other bridge sites.

I. Construction and Life Cycle Costs

The cost of this alternative without water quality treatment is $23,045,733 and with water quality treatment is $51,858,385. Most of the cost is related to the roadway elements, and is significantly greater with water quality control because of the additional fill required. These estimates do not include the cost of optional wildlife features.

Alternative 7	
Alt. 7A – Without Water Quality Control	
Roadway	**$16,110,900**
Bridge	**$6,934,834**
Total	**$23,045,733**
Alt. 7B – With Water Quality Control	
Roadway	**$44,923,519**
Bridge	**$6,934,834**
Total	**$51,858,385**

The life cycle costs for this alternative were developed for two cases: for the roadway alone, and for the total project. For the case without water quality treatment, pavement life cycle costs were calculated at $16,961,032 while the total project life cycle costs were estimated to be $31,003,830. For the case with water quality treatment, pavement life cycle costs were calculated at $26,865,650 while the total project life cycle costs were estimated to be $54,776,745. Paragraph 8 later in this section discusses the life cycle cost analysis.

J. Other Aspects

There are existing features that must remain undisturbed. The Flight 592 Memorial is located north of the L-29 borrow canal near the western limits of the project. This will not be impacted with this alternative. Access will remain at the S-333, S-334, and S-336. Connecting roads will be provided for access to the Airboat Association. Access to the Osceola Camp will be by way of a connecting road from the west.

7. Alternative 8: Existing Alignment with Raised Profile and Box Culverts

A. Description

This alternative is defined as modifying the existing Tamiami Trail profile and typical section throughout the length of the study segment, and the construction of new box culverts to convey Modified Water Deliveries project flows from the L-29 Borrow Canal to Everglades National Park. The box culverts will be 5-foot high by 10-foot wide (inside dimensions) with an invert elevation of 3.0 feet. They will be installed throughout the roadway alignment and will extend through the embankment to ensure that flow is not impeded. For Alternative 8A – Without Water Quality Treatment, the existing culverts are left in place and 24 new box culverts will be constructed. For Alternative 8B – With Water Quality Treatment, 40 box culverts are

required and the existing culverts would be removed from the embankment. The typical section and construction phasing are depicted in Plates A8-1 through A8-10.

As defined, this alternative does not include specific features to accommodate wildlife. Consideration may be given to including various wildlife features as part of this alternative (See Plates WL-1 through 3). To maintain a common basis of comparison between alternatives, these features are discussed separately in Paragraphs 21 and 22. Were they to be included, the wildlife underpasses and land bridges over the L-29 Canal could be constructed in the embankment to the east and west ends of the 4-mile bridge. The underpasses consist of an approximately 50-foot long concrete slab bridge placed in the highway alignment. The land bridges consist of a 24-foot wide concrete bridge with 2 feet of soil spread on its surface for vegetation to grow. Fencing will be needed on each side of the 2 underpasses to funnel wildlife to the underpasses. The typical section, plan views of a portion of this alternative, and construction phasing are depicted in Plates A8-1 through A8-8.

For the condition where there would be no water quality treatment, the centerline of this alignment will fall very close to the centerline of the existing facility. For the condition where there would be water quality treatment, the centerline of the alignment will fall approximately 27 feet to the south, with related wetland encroachment to the south of the existing roadway, due in part to the swales included on either side of the road. There are no significant alignment transitions required at either end of the segment, nor are there any significant impacts to parcels of concern along the corridor.

B. Typical Sections and Pavement Design

- Roadway Typical Section

This typical section consists of two 12-foot wide travel lanes, and 8-foot wide shoulders on each side of the roadway. There is guardrail located at the outside edges of these shoulders.

- Pavement Design: Alternative 8A – Without Water Quality Treatment

This alternative is upgrading the existing roadway to accommodate a Design High Water elevation of 9.3 feet and traffic for 50 years. This is achieved through placing a thick structural overlay. The upgrade needs to consider the impact of the design high water elevation, overtopping, and grade variations.

The recommended approach, which is similar to Alternative 2A, is to leave the existing asphalt pavement in-place as a construction platform and serve as a black base. The low areas shall all be leveled to minimum elevation of 11.0 feet

throughout the project. Then a 6-inch asphalt overlay will be placed. The calculations are summarized below.

First, by considering the project a maintenance effort, thick structural overlays can be used and reconstruction is not necessary. For the existing roadway, using the average elevation of 11 feet, with a 6-inch asphalt thickness, there is slightly more than 1 foot of clearance to the 9.3-foot design high water elevation. In areas where the roadway profiles dip as low as 10 feet, the bottom of the existing 6 inch asphalt is essentially at the Design High Water level.

A reasonable approach is that after leveling to elevation of 11.0 feet with asphalt overbuild, the top 6 inches below elevation 11.0 feet be considered black base. This is quite reasonable because elevation 11.0 feet provides for a foot of clearance from the bottom of the declared black base (elevation 10.5 feet) using either existing granular embankment or asphalt overbuild. In many cases, the asphalt overbuild will be 12 inches thick, providing a total asphalt thickness of 18 inches for over a mile; note this is even before the structural overlay is placed.

Recall that the FWD testing conservatively estimated the embankment modulus at 5,000 psi (the Florida DOT method would predict it at 15,000 psi), and that to account somewhat for the higher water level, the modulus was reduced to 4,000 psi. Using the 50-year projected traffic and an embankment resilient modulus of 4,000 psi, the required structural number is 6.17. Using the effective AASHTO structural number of the existing pavement structure, SNeff, of 3.5, a 6-inch asphalt overlay provides a structural number of 6.14. This is slightly less than the 6.17 inches required, which equates to 0.15 inches of asphalt. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. Plate A2-10 shows the schematic of the pavement section.

A key issue is that the roadway will be close to the Design High Water table, and that more frequent resurfacings are anticipated than a normal roadway. This is in part due to potential localized failures and some settlement of the muck. The geotechnical sub-consultant did a simple settlement calculation of placing a foot of asphalt on top of the existing pavement. The buoyant force of the raised water elevation almost counteracts the weight of the additional asphalt. However, in areas where more than 1 inches of asphalt are placed, settlements are expected. Similarly, if the water elevation seldom reaches 9.3 feet, then there is less buoyant force and additional settlement is expected.

Considering that the existing roadway was resurfaced 7 years ago, and by its cracking condition of 6 is technically ready for a resurfacing, a 7-year resurfacing interval for this option appears warranted. This is considerably more frequent than a 10 to 15 year interval common in Florida; however, the Tamiami Trail is surrounded

by the Everglades and exposed to water throughout the year. The recommended pavement section follows:

Alternative 8A - Roadway Section Without Water Quality Treatment

Proposed centerline elevation = 11.5 feet
_ inch friction course
6 inch structural asphalt
0-12 inch asphalt overbuild
Existing 6 inch asphalt pavement
Existing embankment

- Pavement Design: Alternative 8A - With Water Quality Treatment

This alternative requires widening the embankment footprint to provide water quality treatment facilities on each side of the roadway. After designing the necessary slopes for the treatment facilities, it became obvious that one-half of the roadway would be on new embankment and one-half on the existing embankment. This is an undesirable condition because of differential settlement across the joint. The differential would cause a safety threat to motorists and be a persistent maintenance concern. Therefore, the entire existing embankment is recommend to be removed down to the bedrock, and any additional footprint needed also have the muck removed to the bedrock. A new embankment of A-1 or A-3 material needs to be built.

Reconstruction will require removal of all existing embankment and muck down to the bedrock. The muck removal limits are defined by Florida DOT Standard Index 500. This uses a 1:2 control line starting at the edge of shoulder and descending to the top of bedrock. Within these limits, the muck will be removed and replaced with A-1 or A-3 select material in accordance with Florida DOT Standard Indices 500 and 505.

The pavement thickness is designed using Florida DOT procedures. The design will be most economical if conventional granular materials can be used with the 2-foot separation from the Design High Water elevation of 9.3 feet. Therefore, to provide sufficient clearance to accommodate fluctuations in the water elevation, a new top of asphalt centerline elevation of 14 feet is recommended.

For 50-year traffic of 11.7 million ESALs, a SN of 4.56 is required on an A-3 embankment material, which has a modulus of 12,000 psi. The pavement design below provides a SN of 4.52, which is slightly less than 4.56. Considering this is a 50 year outlook and that there will be numerous periodic resurfacings, any additional thickness deemed necessary can be added with the resurfacings and considered a staged construction. The recommended pavement section is as follows:

Alternative 8B – Roadway Section With Water Quality Treatment

Proposed centerline elevation = 14 feet
_ inch friction course
4 inch structural asphalt
10 inch limerock base course
12 inch LBR stabilized subbase
A-1 or A-3 embankment
4 inch drainage layer
A-1 or A-3 embankment

To illustrate the clearances, if the top of pavement is at elevation 14 feet, the bottom of the limerock base is at elevation 12.75 feet, providing about 3.5 feet of clearance above the Design High Water elevation of 9.3 feet. This exceeds the 2-foot minimum.

As an added precaution against capillary rise from the water table, a 4-inch granular drainage layer is placed beneath the LBR 40 subbase. The drainage layer will be designated to have no material smaller than the No. 8 sieve, which will inhibit the capillary rise into the base layers and still have construction stability. The drainage layer will need to be wrapped in filter fabric to prevent intrusion of the embankment soils into the layer.

The periodic resurfacing interval recommended for this alternative is 12 years. This is the lower end of the typical 10 to 15 year interval in Florida. This is because even with the precautions of the drainage layer and additional high water clearance, the roadway is still in the Everglades and has ample access to water and maybe even unforeseen high water events.

C. Plan and Profile

The proposed profile is to be raised to provide a set clearance from the controlled high water elevation to the bottom of the proposed roadway subgrade. The set clearance is to meet FDOT design criteria, as well as drainage criteria. The proposed elevation at the crown of the roadway is 11.5 feet for the option without water quality treatment, and 14.0 feet for the option with water quality treatment.

D. Structures

Box Culverts

Alternative 8 incorporates the use of 24 new box culverts along with retention of the existing box culverts for Alternative 6A, and 40 new box culverts and removal of the existing culverts. The culverts are to be 5 feet high and 10 feet wide inside

dimensions. It is anticipated precast concrete sections will be used, with a nominal wall thickness of 1 foot. The Corps of Engineers has requested the invert elevations be at 3 feet. Referring to Plate BC-1, the elevation of the existing bedrock is nominally at 3 feet, therefore shallow excavation of the bedrock will be required.

The method of excavating the bedrock will need to be by breaking with air-hammers mounted to large track hoes, and then excavating. Note that blasting is not permissible. The bedrock excavation depth is recommended to be 18 inches. This will allow for a nominal 6 inch bedding layer of a stiff flowable fill (sand-cement mixture) to be placed as a mud slab foundation for the culverts. It will also fill any exposed voids in the bedrock, preventing piping of embankment soils into the exposed voids. The flowable fill mixture will have a maximum compressive strength of 300 psi.

For the alternatives without water quality treatment, the existing roadway embankment will remain. The embankment and bedrock will be excavated and the box culverts set. The backfill will be flowable fill beneath the roadway and shoulders, with the area contained by A-3 fill outside the shoulders. For the alternatives with water quality treatment, the box culvert may be installed either before or after embankment construction. Plate BC-1 shows the typical installation.

Two installation schemes have been identified for the new box culverts for the "without water quality treatment" condition. The first entails a detour to be built to the south in a fashion similar to that considered for short bridges (See Plate A8-6). This option has the disadvantage of a relatively large detour configuration for a small work area, and related cost and temporary environmental impacts to adjacent wetlands.

The second option involves shifting traffic within the existing roadway and shoulder area to the north excavating and constructing a gabion wall, installing half of the culvert, restoring the embankment and roadway base and pavement, then repeating the operation on the north side. This approach will require about 12 feet of temporary encroachment to the south for additional fill to facilitate a two-phase culvert installation while maintaining two-way traffic flow. This option is approximately 40% of the cost of the first option.

For the alignment configuration with water quality treatment, the roadway section is shifted so that there is no real maintenance of traffic issue for the box culvert installation.

Wildlife Features

Wildlife road undercrossings and canal crossings are not included in this alternative as defined and costed – they are considered an optional feature. However, the structural aspects of these crossings is provided herein for reference.

- Wildlife Roadway Undercrossing Bridges

The proposed typical section for this 43'-1'' wide bridge provides sufficient deck area for two 12-foot wide travel lanes, and 8-foot shoulders on both sides of the travel lanes. Refer to Plate WL-1 for a description of the bridge length and the associated opening for wildlife to pass under the bridge.

The superstructure and substructure shown for the wildlife undercrossing is based on other wildlife undercrossing bridges of similar configuration developed for various FDOT Construction Projects. From this information, the proposed bridge structural system is assumed to be a cast-in-place flat slab supported on pile bents using 18-inch square prestressed concrete piles installed and driven in holes predrilled to El. –10.00 into the limerock. The abutments form a vertical wall with precast panels behind the piles retaining the embankment.

Methods for placement of cranes and delivery of material, such as piles, precast beams, and concrete is similar to other mainline bridge replacement alternatives described elsewhere in the report.

- Wildlife Canal Crossing

The proposed typical section for this 27'-1'' wide bridge provides sufficient deck area for a 14-foot wide wildlife passage bounded by a 5-foot landscape buffer on each side. Refer to Plate WL-3 for a description of the bridge length, the canal clearances and hydraulic opening. Standard traffic railing barrier is proposed to retain the natural earth on the bridge, and provides a similar exterior look as all the other vehicular traffic bridges.

The proposed bridge structural system of an AASHTO Type II superstructure with cast-in-place concrete deck supported on pile bents using 18-inch square prestressed concrete piles. Standard construction procedures can be utilized for this bridge with little impact to existing traffic. Maintenance of traffic requirements are discussed under Subparagraph H.

E. Drainage

Two drainage alternatives are being considered for the proposed reconstruction. Due to potential wetland impacts resulting from the construction of water quality

treatment facilities, a detailed analysis has been performed, estimating wetland impacts both with and without water quality treatment facilities. In doing so, the permitting agencies will have a chance to determine whether wetland impacts offset the required water quality treatment.

If water quality treatment requirements are met, dry linear retention facilities will be constructed adjacent to the proposed roadway. The invert elevations are set 1 foot above the new high control elevation of Canal L-29, which is 8.5 feet. As such the treatment facilities will have a control elevation of 9.5 feet and an overall depth of 1 foot. Based on water quality requirements by FDEP (including OFW considerations), the depth of the water quality volume provided is estimated at 0.5 feet deep.

F. Utilities

There are existing utilities within the corridor that will be affected by the new construction. There are buried telephone facilities running behind the guardrail on the north and south sides of the roadway. There is also a 23 kv overhead electric line running along the south side; located about 100 feet south of the existing guardrail. Just behind the guardrail on the north side of the roadway is an additional buried telephone facility.

All utilities within the proposed typical section will need to be relocated. Utility relocations will be coordinated with each utility owner. As the underground utilities appear to fall within the right-of-way, their relocation costs are not included in the cost estimates.

G. Environmental Factors

As the roadway portion of this alternative without water quality treatment preserves the existing facility, it has limited environmental impact except at the locations of the new box culverts, which require minimal excavation at the downstream end. As much of the footprint of this alternative with water quality treatment is located to the south of the existing facility, it has more significant environmental impact to Everglades National Park.

The alignment without water quality treatment has no permanent encroachment except at new box culverts where there would be an added 25 feet of encroachment to the south. The option with water quality treatment encroaches approximately 57 feet to the south with additional encroachment of 25 feet at box culvert locations. The alternative without water quality treatment has no permanent encroachments except for the added impacts of 0.8 acres for the box culverts as previously noted.

The alternative with water quality treatment has a total of 73.3 acres of encroachment.

H. Maintenance of Traffic During Construction

Alternative 8A

Traffic is to be maintained as it exists today. The overlay of the existing roadway will be accomplished using a moving operation. Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an "as needed, just-in-time" basis at the work site.

Alternative 8B

Temporary barricades spaced every 50 feet are placed at the north edge of the westbound travel lane line. In 1/4-mile increments, the existing guardrail is to be removed, and replaced with temporary barrier wall. The existing shoulder is to be removed and replaced with temporary pavement. Once completed for the entire project length, traffic is shifted to the north, utilizing the new pavement. A ten-foot wide strip of temporary pavement is placed south of the existing centerline to allow the roadway to slope to the north at 2%. A temporary concrete barrier is placed one foot north of the south edge of the temporary pavement.

Unsuitable material is excavated and embankment is placed and compacted along the proposed alignment. The southern guardrail, eastbound shoulder and both travel lanes are constructed. A temporary barrier wall is placed adjacent to the westbound travel lane and traffic is shifted to the new pavement. The westbound shoulder and guardrail are constructed and the existing roadway is removed.

Staging areas for construction equipment and materials could be located on the business parcels along the corridor that are to be acquired or are not actively used now. Otherwise, staging and other functions may need to utilize sections of the existing shoulder for temporary periods. It may be necessary to have a staging area near the east end of the corridor, with materials moved in the remaining short distance on an “as needed, just-in-time basis at the work site.

Wildlife Crossings

Wildlife crossings are not included in this alternative as defined and costed – they are considered an optional feature. However, the construction of these crossings is

provided herein for reference. There are three options for the horizontal layout of the proposed wildlife bridges. Of the three, the temporary detour option similar to that used for other short mainline bridges on other alternatives was selected because it maintains a straight roadway alignment and reduces permanent wetland encroachment. This option is more costly since it requires the construction of a temporary roadway, reconstruction of the existing roadway on the approach to the new bridge, and removal of the temporary roadway.

Offset Final Alignment to the South

The first option is permanently offsetting these new structures to the south of the existing roadway alignment. Due to the change in elevations from the existing roadway (±10.4 feet) to the proposed bridge deck (±17 feet), shifting the alignment to locate the structure outside of the existing typical section allows for a less complex maintenance of traffic scheme. Once the proposed bridges and their transitions are completed, they can be opened up to traffic flow, and the existing roadway will be removed at the bridge opening. These breaches will allow for the flow of water under the bridge. Because this option involves permanent wetland encroachment and introduces undesirable roadway geometry, it is not considered further.

Offset Temporary Detour to South

The second option involves the construction of a temporary roadway that is offset to the south from the existing roadway. Once this detour is built, traffic is then shifted onto this temporary alignment, and the new structure and its approaches are constructed along the existing alignment. The shift in traffic will allow for the de-mucking operation that will be required along the new raised profile.

Offset Temporary Detour North into L-29 Canal

The detour on the north side of the existing roadway for the construction of 2 wildlife crossings requires two 1,200-foot long approach bridges and a 1,050-foot long temporary steel truss bridge (Bailey bridge) per each bridge site. The width of the temporary bridge is 32 feet, which provides two 12-foot wide travel lanes, and 4-foot shoulders on both sides of the travel lanes. The gap between the existing roadway and the detour is kept to minimum (10 feet) to minimize the length and width of approach bridges. The required width of the approach bridges is 42 feet.

The construction method and the superstructure system proposed for the permanent bridges are dictated by limited construction area available. Post-tensioned precast slab units with top-down construction are proposed as a viable alternative. The optimum span length for this type of superstructure was determined to be around 30

feet. The most cost effective substructure system for these bridges is 18-inch square prestressed concrete piles.

The cost analysis is based on the construction of one bridge at a time and reuse of superstructure of temporary and approach bridges at other bridge location.

- Approach Bridges

One line of 36-inch diameter drilled shafts at every 30 feet is proposed in the L-29 Canal to minimize the interruption of flow with another line of 36-inch diameter drilled shafts along the bank. This type of substructure configuration will require a superstructure system spanning along the width of the bridge. The best-suited superstructure system for this bridge is post-tensioned precast slab units. Precast slab units will be reused at other bridge sites.

- Temporary Bridge

The proposed temporary bridge is a 1,050-foot long, two lane Bailey bridge with 30-foot spans. The bridge will be supported on piers with two 36-inch diameter drilled shafts. Drilled shafts in the L-29 Canal will line up with the drilled shafts of the approach bridges to minimize the interruption of flow. Temporary bridges will be reused at other bridge sites.

I. Construction and Life Cycle Costs

The cost of this alternative without water quality treatment is $45,499,995 and with water quality treatment is $47,081,029. Most of the cost is related to the roadway elements, and is significantly greater with water quality control because of the additional number and length of box culverts. These costs do not include any optional wildlife features.

Alternative 8	
Alt. 8A – Without Water Quality Control	
Roadway	**$12,421,131**
Bridge	**$0**
Box Culverts	**$33,078,864**
Total	**$45,499,995**
Alt. 8B - With Water Quality Control	
Roadway	**$43,791,549**
Bridge	**$0**
Box Culverts	**$3,289,480**
Total	**$47,081,029**

As is discussed in Paragraph 21.A, for Alternative 8A the cost of box culverts could be reduced about 60% by using the alternate construction method mostly within the existing embankment or by installing the culverts in groups of three (either provides about $18.5 million in savings), reducing the cost of Alternative 8A to about $27.0 million. If both techniques were used, the additional savings is approximately $7.0 million, reducing the project cost to about $20.0 million. About $31million of the $33 million for box culverts is involved with the cost of full detours. Savings of $18 to $25 million can be realized by utilizing the alternate construction method and/or by grouping the box culverts.

The life cycle costs for this alternative were developed for two cases: for the roadway alone, and for the total project. For the case without water quality treatment, pavement life cycle costs were calculated at $14,302,117 while the total project life cycle costs were estimated to be $53,892,652. For the case with water quality treatment, pavement life cycle costs were calculated at $26,338,079 while the total project life cycle costs were estimated to be $50,587,749. Paragraph 8 later in this section discusses the life cycle cost analysis.

J. Other Aspects

There are existing features that must remain undisturbed. The Flight 592 Memorial is located north of the L-29 borrow canal near the western limits of the project. This will not be impacted with this alternative. Access will remain at the S-333, S-334, and S-336. Access to Tiger Tail Camp, located on the north side of the canal, will remain as it is today. Access points to the Osceola Camp and the Airboat Association, located on the south side of the existing roadway will remain.

8. Life Cycle Cost Analysis

A life cycle cost analysis was prepared for the alternatives, to include those configurations with and without water quality treatment.

The analyses were based on a 50-year term using a 4% interest rate. While bridges are designed for a 75-year service life, no salvage value was presumed at the end of the analysis period for the bridges or any other features. Minor recurring costs of bridge inspection were also not considered. Other maintenance costs were considered to be similar between the alternatives and therefore not a substantial influence in the outcome.

Because of the importance of the issue of overlaying the existing roadway versus reconstructing it under the various alternatives and their variations, the life cycle cost was calculated by alternative for two cases: for the total project and for the pavement-related elements only. In this way, the relative merits of the pavement

options could be assessed separately from other project components. "Roadway Cost Only" refers to the installed cost of pavement and subgrade, excluding other improvements and excluding additive cost which is the estimate contingency.

Specific assumptions for the two pavement cross section scenarios are presented in the following table:

Life Cycle Cost Assumptions (Pavement)

Overlay Construction [Applies to Existing Roadway Improved to Standards, Alternative 1 (Without Water Quality Treatment) and Alternatives 2A, 6A, 7A, and 8A - Without Water Quality Treatment]

7-year maximum overlay life, based on continued settlement caused by muck, and the fact that it has deteriorated to a condition of 6 over the past 7 years.

Overbuild quantity assumed over 50% of the road because of the continued differential settlement and the necessity to restore cross slope.

Thicker removal and replacement required (3" assumed) because of the increased possibility of structural problems (evidenced by the beginning of cracking in one of the thicker cores). Also, the pavement structure will be more susceptible to structural problems due to increased water level.

To summarize the overlay requirements, the following table of pavement materials is provided:

Friction Course	_"
Structural Course	6"
Variable depth leveling course to remove surface deviations and restore cross slope	0-12"
Existing roadway (considered LBR-40 subbase).	12" minimum

Reconstructed Roadway Section (Applies to Alternatives with New Embankment Construction (including subgrade), including Alternatives 2B, 6B, 7B and 8B With Water Quality Treatment, and Alternatives 3, 4, and 5 With and Without Water Quality Treatment]

12-year maximum overlay life, based on the fact that the muck will be removed and differential settlement will cease.

Removal of muck means that no overbuild will be required.

New pavement structure will be more resistant to fluctuations in water level. As a result, structural problems are not likely.

Because of this, a thinner "functional" removal and replacement is required (2.25" assumed).

Overlay Construction

The 50-year roadway designs will require periodic maintenance activities. These include resurfacings and a complete guardrail replacement. As discussed under the alternatives that only use an asphalt overlay (namely Upgrade the Existing and Alternative 2A - Without Water Quality Treatment) and likewise Alternatives 6A, 7A, and 8A, more frequent resurfacings will be required due to the proximity of the water table. It is anticipated that the resurfacings will be required due to future settlements and localized pavement failures. As the existing pavement has deteriorated to a condition of 6 in the past 7 years, it is recommended that a 7-year mill and resurfacing interval be used.

In addition, it is anticipated that sometime over the next 50 years, guardrail standards will change. It is therefore anticipated that a complete guardrail replacement will occur in about 30 years.

Roadway Reconstruction Life Cycles

Reconstructed roadways are those that are on embankments rebuilt from the bedrock with all muck removed. In particular, this would include Alternatives 6B, 7B, and 8B. The bridge approaches of Alternatives 1 and 5 are short and would be covered under the periodic maintenance Work Program for the remainder of the roadway. For the reconstruction alternatives, a longer mill and resurfacing interval of 12 years is recommended. This is due to the reconstructed embankment and the higher roadway elevations providing greater water separation.

In addition, it is anticipated that sometime over the next 50 years, guardrail standards will change. It is therefore anticipated that a complete guardrail replacement will occur in about 30 years.

Summary of Results

The results of the life cycle cost analysis are presented in Table 1. It is seen that the pavement life cycle cost results parallel those for the prior alternatives in that the alternatives without water quality treatment have a lower total roadway and total project life cycle cost than those with water quality treatment because of lower investment in the pavement section despite more frequent pavement overlays. Even though the overlay approach has a roadway maintenance life cycle cost of $3.3 to $5.3 million, this amount is more than offset by the cost to rebuild the entire embankment (as shown in Column F of the table).

The results of the life cycle cost analysis for the total project alternatives show the alternatives ranked from lowest to highest cost as follows:

Table 1

LIFE CYCLE COST ANALYSIS	<A>	<B>	<C>	<D>	<E>	<F>	<G>	<H>
ALTERNATIVE	*Roadway Cost Only (No Additives)*	*Resurfacing Interval (Yr.)*	*Roadway Area (SY mainline)*	*Roadway Maint. Life Cycle Cost (per SY)*	*Roadway Maint. Life Cycle Cost (Present Worth) [D X C]*	*Total Roadway Life Cycle Cost (Present Worth) [A + E]*	*Total Construction Cost [MCACES]*	*Composite Life Cycle Cost for Alternative (Present Worth) [E+G]*
6A - No Water Quality Treatment	$7,119,795	7		$54.32	$5,116,075	**$12,235,870**	$72,877,979	**$77,994,054**
6B - Water Quality Treatment	$17,065,880	12						
7A - No Water Quality Treatment	$9,002,935	7	146,504	$54.32	$7,958,097	**$16,961,032**	$23,045,733	**$31,003,830**
7B - Water Quality Treatment	$23,947,290	12						
8A - No Water Quality Treatment	$5,909,460	7	154,504	$54.32	$8,392,657	**$14,302,117**	$45,499,995	**$53,892,652**
8B - Water Quality Treatment	$23,260,359	12						

SY Life Cycle Costs for pavement increased to include shoulders. Maintenance cost for structures not included.
New bridges are not offset, and utilize temporary detour to south for construction.
Operational cost considered comparable for each alternative. 4% Discount Rate assumed. Prepared: July 15, 2001
"Roadway Cost Only" refers to the installed cost of pavement and subgrade, excluding other improvements and excluding additive costs which are the estimate contingency.

1. Alternative 7A – Without Water Quality Treatment
2. Alternative 8A – Without Water Quality Treatment
3. Alternative 7B – With Water Quality Treatment
4. Alternative 6A – Without Water Quality Treatment
5. Alternative 6B – With Water Quality Treatment
6. Alternative 8B – With Water Quality Treatment

This ordering is somewhat different than the results for the pavement life cycle cost analysis, because of variations associated with structure and box culvert costs. It appears that box culvert alternatives are not cost competitive because of the cost associated with individual detours for each box culvert. The box culvert cost of Alternative 8A, for example, could be cut by about 60% (or $18.5 million) simply by installing the culverts in groups of three, making it cost competitive with Alternative 2A.

9. Comparative Evaluation of Alternatives

The environmental, economic and social and cultural effects of each primary alternative considered are shown in Tables 3 and 4. All the alternatives satisfy the functional requirements dictated by the project objective, namely to convey the Modified Water Deliveries Project flows while addressing roadway subgrade and cross-section requirements of the Florida Department of Transportation for the roadway, including subgrade clearances, with one exception.

It is again noted that Alternatives 6, 7, and 8 have variations with and without the water quality treatment, which amounts to dry retention swales parallel to and on either side of the roadway. The ranking of alternatives according to cost is similar to that for the project life cycle cost listing. Dimensions for wetland encroachment generally extend the length of the corridor, except in the vicinity of bridges where they are minimal.

Several observations can be made upon inspection of the table, as follows:

- Water quality treatment cannot be included in Alternatives 6, 7 and 8 without introducing significant wetland encroachment.
- The inclusion of water quality treatment in Alternatives 6 and 7 increases the project cost, by $8 million for Alternative 6, and over $27 million for Alternative 7. For Alternative 8B, the inclusion of water quality treatment is nominally $1.5 million more in cost, but alternative construction methods and/or grouping could increase this difference such that Alternative 8A is $20 million or more less costly than Alternative 8B.
- The inclusion of water quality treatment necessarily results in wetland impacts, and encroachment into Everglades National Park, although these

are less the longer the length of the bridge between the L-29 Canal and the existing embankment.

- An important issue is the efficacy of removing the existing roadway embankment as in Alternative 6B, 7B, and 8B with water quality treatment versus raising the road on the existing embankment as in Alternative 6A, 7A, and 8A without water quality treatment.
- Box culverts are relatively inexpensive, but the maintenance of traffic costs are very high, rendering them uncompetitive unless actions are taken to reduce the detouring costs. Grouping in threes could save $18 million, as alternatively would an alternate construction method mostly within the existing embankment.
- Impacts to real estate sites, recreational access, and water management infrastructure are generally minimal.

Table 2

SUMMARY COMPARISON OF ALTERNATIVES: Without Water Quality Treatment

(For option with Temporary Road at Bridges for Alts. 6 and 7; No Offset Bridges) Tamiami Trail Modifications 7/10/01

EVALUATION FACTOR	Alt. 6A	Alt. 7A	Alt. 8A		
COST FACTORS					
Construction Cost	$72,877,979	$23,045,733	$45,499,995		
Roadway Cost	$13,432,658	$16,110,900	$12,421,131		
Bridge Cost	$59,445,321	$6,934,834	$33,078,864	Alts. 6A and 8A bridge costs include box culverts and related MOT.	
Annual O&M Cost	$40,000	$40,000	$40,000		
Life Cycle Cost (Pavement only)	$12,235,870	$16,961,032	$14,302,117		
Life Cycle Cost (Total Project)	$77,994,054	$31,003,830	$53,892,652		
ENVIRONMENTAL FACTORS					
Wetland Impact - Permanent	0.3 acres at new culvert ends	No impact.	0.8 acres at new culvert ends		
Wetland Impact - Temporary	3.5 acres (bridge detours) 3.2 acres (box detours)	3.5 acres (bridge detours)	9.6 acres (box detours)		
Water Conservation Area 3B Impacts	No impact.	No impact.	No impact.		
Everglades National Park Impacts	Minor encroachment, including 5-6 feet near bridges. Road runoff is untreated.	Minor encroachment, including 5-6 feet near bridges. Road runoff is untreated.	Minor encroachment.		
Potential Wood Stork Impacts	No clear encroachment - north limits of rookery not well defined.	No clear encroachment - north limits of rookery not well defined.	No clear encroachment - north limits of rookery not well defined.		
Relation to Future Everglades Restoration Actions	Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made before construction.	Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made before construction.	Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made before construction.		
REAL ESTATE FACTORS					
Tiger Tail Camp	None. Access via boat from Trail and from L-29 levee road maintained.	None. Access via boat from Trail and from L-29 levee road maintained.	None. Access via boat from Trail and from L-29 levee road maintained.		

EVALUATION FACTOR	Alt. 6A	Alt. 7A	Alt. 8A		
Osceola Camp	No impact. Driveway will be adjusted for elevation change.	No impact. Driveway will be adjusted for elevation change.	No impact. Driveway will be adjusted for elevation change.		
Airboat Ass'n. of Florida	No impact. Driveway will be connected to bridge.	No impact. Driveway will be adjusted for elevation change.	No impact. Driveway will be adjusted for elevation change.		
Other Property/Features	No impact.	No impact.	No impact.		
Recreational Access	No impact.	No impact.	No impact.		
Access to Water Management Facilities	No impact.	No impact.	No impact.		
CONSTRUCTION FACTORS					
Construction Duration	30 months	24 months	24 months		
Maintenance of Traffic	A "rolling" construction zone as resurfacing progresses. Shifted centerline would permit resurfacing in 2 increments. Temporary detours eliminate conflicts at bridges. Delivery of materials also an issue.	A "rolling" construction zone as resurfacing progresses. Shifted centerline would permit resurfacing in 2 increments. Temporary detours eliminate conflicts at bridges. Delivery of materials also an issue.	A "rolling" construction zone as resurfacing progresses. Shifted centerline would permit resurfacing in 2 increments. The removal and delivery of materials is an issue. Installation of numerous box culverts will create repeated detours.		
Ease of Construction	Somewhat complex.	Somewhat complex.	Somewhat complex.		
ROADWAY ENGINEERING FACTORS					
Horizontal Geometry	No significant change for constant offset condition with bridge on same tangent alignment.	No significant change for constant offset condition with bridge on same tangent alignment.	No significant change for constant offset condition with bridges on same tangent alignment.		
Vertical Geometry	No significant impact.	No significant impact.	No significant impact.		
Pavement Serviceability	Uneven riding surface and maintenance requirement is expected to continue due to settlement of the muck layer. Estimated overlay period is a maximum of 7 years.	Uneven riding surface and maintenance requirement is expected to continue due to settlement of the muck layer. Estimated overlay period is a maximum of 7 years.	Uneven riding surface and maintenance requirement is expected to continue due to settlement of the muck layer. Estimated overlay period is a maximum of 7 years.		

EVALUATION FACTOR	Alt. 6A	Alt. 7A	Alt. 8A		
	Potential for structural problems to develop, since beginning of fatigue cracking seen in one core.	Potential for structural problems to develop, since beginning of fatigue cracking seen in one core.	Potential for structural problems to develop, since beginning of fatigue cracking seen in one core.		
Safety and Operations	No significant change for option where new bridge is on tangent alignment.	No significant change for option where new bridge is on tangent alignment.	No significant change.		

Table 3
SUMMARY COMPARISON OF ALTERNATIVES: With Water Quality Treatment
(For option with Temporary Road at Bridges for Alts. 6 and 7; No Offset Bridges) Tamiami Trail Modifications 7/10/01

EVALUATION FACTOR	Alt. 6B	Alt. 7B	Alt. 8B		
COST FACTORS					
Construction Cost	$81,369,677	$51,858,385	$47,081,029		
Roadway Cost	$13,432,658	$44,923,519	$43,791,549		
Bridge Cost	$67,937,019	$6,934,834	$3,289,480	Alts. 6A and 8A bridge costs include box culverts and related MOT.	
Annual O&M Cost	$40,000	$40,000	$40,000		
Life Cycle Cost (Pavement only)	$18,942,025	$26,865,650	$26,338,079		
Life Cycle Cost (Total Project)	$83,245,822	$54,776,745	$50,158,749		
ENVIRONMENTAL FACTORS					
Wetland Impact - Permanent	0.3 acres at new culverts 50.0 acres roadway	67.4 acres roadway	3.2 acres at new/old culvert ends 71.0 acres roadway		
Wetland Impact - Temporary	3.5 acres (bridge detours) 3.2 acres (box detours)	3.5 acres (bridge detours)	16.0 acres (box detours)		
Water Conservation Area 3B Impacts	No impact.	No impact.	No impact.		
Everglades National Park Impacts	Significant encroachment of 51 feet the length of the corridor, with 5-6 feet more near bridge ends.	Significant encroachment of 51 feet the length of the corridor, with 5-6 feet more near bridge ends.	Significant encroachment of 51 feet the length of the corridor.		
Potential Wood Stork Impacts	Road widened 51 feet to the south for the length of the corridor, with 5-6 feet more near bridge. No clear encroachment - north limits of rookery not well defined.	Road widened 51 feet to the south for the length of the corridor, with 5-6 feet more near bridge. No clear encroachment - north limits of rookery not well defined.	Road widened 51 feet to the south for the length of the corridor. No clear encroachment - north limits of rookery not well defined.		
Relation to Future Everglades Restoration Actions	Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made	Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made	Significant investment in new bridges and elevation of roadway. Any adjustments for future conditions should be made		

EVALUATION FACTOR	Alt. 6B	Alt. 7B	Alt. 8B		
	before construction.	before construction.	before construction.		
REAL ESTATE FACTORS					
Tiger Tail Camp	None. Access via boat from Trail and from L-29 levee road maintained.	None. Access via boat from Trail and from L-29 levee road maintained.	None. Access via boat from Trail and from L-29 levee road maintained.		
Osceola Camp	South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change.	South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change.	South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change.		
Airboat Ass'n. of Florida	South edge of roadway 51 feet closer. Driveway will be adjusted to connect to bridge.	South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change.	South edge of roadway 51 feet closer. Driveway will be adjusted for elevation change.		
Other Property/Features	No impact.	No impact.	No impact.		
Recreational Access	No impact.	No impact.	No impact.		
Access to Water Management Facilities	No impact.	No impact.	No impact.		
CONSTRUCTION FACTORS					
Construction Duration	30 months	24 months	28 months		
Maintenance of Traffic	Only limited impact with the connections at either end. The removal and delivery of materials is an issue.	Only limited impact with the connections at either end. The removal and delivery of materials is an issue.	Only limited impact with the connections at either end. The removal and delivery of materials is an issue. Installation of numerous box culverts will create repeated detours.		
Ease of Construction	Somewhat complex.	Somewhat complex.	Somewhat complex.		
ROADWAY ENGINEERING FACTORS					
Horizontal Geometry	No significant change for constant offset condition with bridge on same tangent alignment.	No significant change for constant offset condition with bridge on same tangent alignment	No significant change.		
Vertical Geometry	No significant impact.	No significant impact.	No significant impact		
Pavement Serviceability	New pavement from the limestone bedrock up is	New pavement from the limestone bedrock up is	New pavement from the limestone bedrock up is		

EVALUATION FACTOR	Alt. 6B	Alt. 7B	Alt. 8B		
	expected to have excellent performance with low life cycle/ maintenance costs Estimated overlay period is 12 years. The chance for reuse of the levee material exists, reducing the amount of new fill required. Drainage layer allows greater protection from variable water levels.	expected to have excellent performance with low life cycle/ maintenance costs Estimated overlay period is 12 years. The chance for reuse of the levee material exists, reducing the amount of new fill required. Drainage layer allows greater protection from variable water levels.	expected to have excellent performance with low life cycle/ maintenance costs Estimated overlay period is 12 years. The chance for reuse of the levee material exists, reducing the amount of new fill required. Drainage layer allows greater protection from variable water levels.		
Safety and Operations	No significant change for option where new bridge is on tangent alignment..	No significant change for option where new bridge is on tangent alignment.	No significant change.		

C. OTHER ALTERNATIVE CONFIGURATIONS INVESTIGATED

10. Introduction

As part of the review of the Preliminary Design (75%) Submittal document for the Engineering Appendix, and based on comments received at an interagency coordination meeting, several technical topics were identified for which it was determined that additional information to augment the Preliminary Design (75%) submittal. This additional data would be useful in refining certain aspects of the original roadway alternatives and in examining slight modifications to the alternatives which might yield variations with fewer adverse impacts.

This information was compiled into an Interim Summary Report which was a compilation of the responses prepared to address the eight specific topic areas for which additional technical information was requested. As part of the Final Design (100%) Report, this additional information was incorporated into this section of the report, except for one topic detailing construction methods for the basic alternatives. That information was incorporated into the narrative describing maintenance of traffic for each of the alternatives.

The preceding analyses were originally performed for the initial five alternatives. For completeness and evaluation consistency, the same eight specific topic areas were addressed for the three additional alternatives which are the subject of this Addendum. It is noted that the embankment sections of Alternatives 6A, 7A, and 8A are identical by definition to the embankment section of Alternative 2A, and that the the embankment sections of Alternatives 6B, 7B, and 8B are identical by definition to the embankment section of Alternative 2B. All relevant plates in the WQ series are contained in the Engineering Appendix dated December 22, 2000 and are not repeated in this Addendum, except for Plate WQ-1.

11. Creative Water Quality Options

Information Request

Identify and discuss “creative” water quality treatment (WQT) techniques for Alternative #2 that will minimize potential wetland impacts. Possible “creative” WQT techniques include, but should not be limited to, using reinforcement to steepen slopes, wet detention, using curb and gutter outside of the guardrail, etc. If a viable solution is identified, note whether it can be applied to other alternatives.

Additional Information

1. Background

The initial definition of the set of alternatives considered for the Tamiami Trail corridor incorporated a simple, straightforward approach to meeting water quality treatment standards - dry retention systems were proposed on both sides of the roadway. This type of system is relatively simple to build and maintain. However, in consideration of the required wider footprint for the original Alternatives 2B, 3B and 4B with water quality treatment as well as for the embankment sections of additional Alternatives 6B, 7B and 8B, and the resultant impacts to existing wetlands in Everglades National Park, the need to explore "creative" water quality treatment options was identified, and several such options have been evaluated. It was determined that the options would be applied to Alternative 2B - With Water Quality Treatment (Dry Retention Swales), and the applicability to the original alternatives. This analysis has been extended to Alternatives 6B, 7B and 8B and the results of this evaluation are summarized in this section.

The primary objective with all options considered was to lessen the width of the required footprint for the roadway section from toe-of-slope to toe-of-slope, thus reducing the area of existing wetlands affected by the project. This was pursued by considering alternate water quality treatment options, compressing the typical section, and encroaching into the L-29 Canal.

Plates depicting typical sections and related features of the options are included at the end of this section.

2. Definition of Potential “Creative” Water Quality Treatment Techniques for Alternative 2B

The following "creative" water quality treatment strategies have been identified and have been developed in view of the relevant regulatory requirements, and reviewed in terms of feasibility, cost, constructibility, impacts to wetlands, relevance to other alternatives:

Option 1: Shifting and/or compressing the roadway section.
Option 2: Exfiltration trenches with curb and gutter.
Option 3: Exfiltration trenches with shoulder gutter.
Option 4: Wet detention system.
Option 5: Single dry retention swale.

The five options are described as follows:

Option 1: Shifting and/or Compressing the Roadway Section.

This option entails shifting the typical section for Alternative 2B - With Water Quality Treatment (Dry Retention Swale) to the north. In conjunction with this modification, the resulting encroachment into the L-29 Canal would be accommodated by widening the canal to the north, or by using vertical wall sections in two different configurations to reduce the width of the typical section in the area of the dry retention swales. These three options are discussed as follows:

Option 1-A: Shift Alignment and Compress Swale With Wall Elements/South Side (Alt. 2C)

In this option, the typical section would be compressed by installing a wall system on the south side of the roadway that would reduce encroachment into the wetlands of Everglades National Park, without any encroachment into the L-29 Canal. The construction of a reinforced wall along the south side of the existing roadway is included to minimize the extent of this encroachment, and the dry retention area is compressed between this taller wall and a short gravity wall.

The configuration permits construction of the raised roadway and walls to the south of the existing roadway with a temporary wall system. If the centerline of the new roadway section were not offset sufficiently from the existing centerline, it would not be possible to construct the new section literally on top of the existing section.

The existing pavement, sub-grade, fill and muck will be removed totally and back-filled with appropriate fill to the bottom of the sub-grade. A double wall section is proposed on the south side providing a 5-foot wide dry retention area. The placement of this walled section on the south side provides adequate space on the north side to provide again a 5-foot wide dry retention area with standard reinforced side slopes. Runoff from the south side of roadway would enter the south side swale through barrier wall inlets, whereas runoff from the north side would sheet flow into the north side retention area. The bottom elevation of the swales would be the same as for Alternative 2 With Water Quality Treatment (Dry Retention Swale), which is elevation 9.5 feet, one foot above the high water level control elevation, 8.5 feet.

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final

configuration. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The additional profile elevation affects the section width, but requires 29 feet less in width compared to Alternative 2B - With Water Quality Treatment (Dry Retention Swales, for a net impact of 21 feet of wetland impact. This is in comparison to 50 feet of impact for the original Alternative 2B - With Water Quality Treatment (Dry Retention Swales). This option does not encroach into the hydraulic capacity of the L-29 Canal.

The estimated cost for this alternative is $132,214,250 for the length of the corridor. This is a $73,663,600 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Option 1-B: Shift Alignment and Compress Swale With Wall Elements/ North Side (Alt. 2D)

In this option, the typical section would be compressed by installing a wall system that would encroach into the L-29 Canal sufficiently so that there would be no encroachment into the wetlands of Everglades National Park on the south side of the roadway. The construction of a reinforced wall along the north side of the existing roadway entails the placement of piles and concrete panels in the L-29 Canal at an elevation near the bottom of the canal.

The existing pavement, sub-grade, fill and muck will be removed totally and back-filled with appropriate fill to the bottom of the sub-grade. A double wall section is proposed on the north side providing a 5-foot wide dry retention area. The placement of this walled section on the north side provides adequate space on the south side to provide again a 5-foot wide dry retention area with standard reinforced side slopes. Runoff from the north side of roadway would enter the north side swale through barrier wall inlets, whereas runoff from the south side would sheet flow into the south side retention area. The bottom of the swales would be the same as for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), which is elevation 9.5 feet, one foot above the high water level control elevation, 8.5 feet.

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this scheme because of the

roadway elevation differentials and the need for the temporary wall.

This option does encroach into the hydraulic capacity of the L-29 Canal, removing about 200 square feet of flow area. This loss can be compensated for by removal of a like area along the north bank of the canal, or by deepening the canal by the same area.

The estimated cost for this alternative is $160,484,850 for the length of the corridor. This is a $101,934,200 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Option 1-C: Shift Typical Section North into L-29 Canal (Alt. 2E)

In this option, the typical section for Alternative 2B – With Water Quality Treatment (Dry Retention Swales) would be shifted northward, encroaching into the L-29 Canal. The extent of encroachment is approximately 50 feet, such that the south bank of the canal would need to be filled in and the north bank of the canal would require excavation by the same amount.

While this is conceptually feasible, there are several issues associated with it. First, as the canal is approximately 100 feet wide presently, the 50 feet of widening to the north will consume most of the flat plateau to the north. It may be possible to excavate the lower portion of this replacement widening at a steeper slope so as to replace the lost area with a section that is less in width. This would allow for a relocated canal maintenance road and would permit the telephone and fiber optic utilities to remain in place. Turbidity control during excavation could also be a concern.

Another issue is the method for filling in the canal so that sufficient load capacity is achieved and that the fill is stable. This will be difficult to achieve underwater, and will also raise issues of turbidity control during fill placement. It may be necessary to use the construction method noted for Option 1-B wherein a concrete panel wall is constructed to contain the fill material. This approach would also reduce the lost cross-sectional area in the canal such that less excavation would be required to the north. However, this wall system would significantly increase the cost of the solution.

Other issues associated with this concept are preserving the required canal section in the vicinity of the Tiger Tail Indian Camp, the recreational area in the east part of the corridor next to the levee, at existing structures S-355A and S-355B, and at the site of the four proposed weir structures. In these areas, several solutions could be considered. The roadway section could be shifted to the south to avoid any impact, but would incur encroachment into wetlands in Everglades National Park. Also, to effect such an offset and the pair of alignment transitions at up to eight locations in

the corridor could result in an unacceptably “wavy” alignment with safety implications. It appears that, if the extent of canal excavation is reduced from 50 feet to 25-30 feet, then the existing and future water control structures would not be affected.

Another solution would be to place the roadway on structure in these areas over the canal. However, considering the lengths involved this would add significant cost.

If impact to the water control structures is avoidable, then perhaps the compromise strategy at the Tiger Tail Indian Camp and the eastern recreational area would be to shift the alignment at these locations and incur some wetlands impact. A total distance of about 3,500 feet of the roadway would encroach into the wetlands in each of these areas, with the extent of the encroachment ranging up to 59 feet per the template for Alternative 2B - With Water Quality Treatment (Dry Detention Swales). This would yield a wetland impact of 2.7 acres per location or a total of 5.4 acres. The use of the vertical wall system as discussed for Options 1-A and 1-B would moderate the impact at additional cost so that there would be no encroachment into the wetlands of Everglades National Park on the south side of the roadway. However, application of this concept would make Option 1-C identical to Option 1-B.

Constructibility for this alternative would require that the traffic lanes be shifted to the south within the existing roadway and a temporary wall system be installed adjacent to this roadway on the north side. Then the remaining existing embankment on the north side would be removed and the new embankment installed in this area and in the canal up to the elevation of the existing road. The existing pavement, sub-grade, fill and muck will be removed totally and backfilled with appropriate fill to the bottom of the sub-grade.

This step would be preceded by the placement of the wall system in the canal if that were determined to be necessary. The temporary wall system would be extended upward to permit the completion a portion of the new roadway. Traffic would be shifted to the new roadway and the south portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. There is a cost premium associated with this phasing scheme because of the roadway elevation differentials and the need for the temporary wall.

This option does encroach into the hydraulic capacity of the L-29 Canal, removing about 900 square feet of flow area.

For the configuration where the canal fill is not contained by a wall, and a like area is excavated from the north bank, the estimated cost for this alternative is $73,917,450 for the length of the corridor. This is a $15,366,800 additive to the cost of Alternative

2B - With Water Quality Treatment (Dry Retention Swales). It is also assumed that the water control structures would not be affected and that the alignment would be shifted at the other two locations. These cost estimates do not include relocation of utilities on the levee or a wall system for retaining fill on the south bank of the canal.

Option 2: Exfiltration Trenches With Curb and Gutter

The second category of option is to use an exfiltration trench below the roadway, with roadway runoff routed from a curb and gutter section with inlets spaced every 200 feet due to the flat roadway profile. The exfiltration trench would be comprised of an 18-inch perforated pipe surrounded by coarse aggregate and extending for the length of the corridor, less the bridge sections, on both sides of the roadway.

The concept would allow the collected runoff to infiltrate from the pipe into the surrounding aggregate and dissipate into the adjacent fill material. The trench will have an envelope of filter fabric to prevent the migration of any sand material into the rock trench. This option does require the invert of the exfiltration trench pipe to be above the design high water elevation of the L-29 Canal, which is elevation 9.3 feet. As such, the profile of the roadway would need to be approximately 2 feet higher than for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), or a centerline elevation of 16.0 feet.

The additional profile elevation affects the section width, but requires 17 to 27 feet less in width compared to Alternative 2B - With Water Quality Treatment (Dry Retention Swales), without and with stabilized side slopes respectively, for a net impact of 23 to 33 feet of wetland impact. This is in comparison to 50 feet of impact for the original Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B as discussed previously. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The estimated cost for this alternative is $76,116,250 for the length of the corridor.

This is a $17,565,600 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Option 3: Exfiltration Trenches With Shoulder Gutter

The third option is to use an exfiltration trench below the roadway, with roadway runoff routed from a shoulder gutter section with inlets spaced every 200 feet due to the flat roadway profile. As for Option 2, the exfiltration trench would be comprised of an 18-inch perforated pipe surrounded by coarse aggregate and extending for the length of the corridor, less the bridge sections, on both sides of the roadway.

The concept would allow the collected runoff to infiltrate from the pipe into the surrounding aggregate and dissipate into the adjacent fill material. The trench will have an envelope of filter fabric to prevent the migration of any sand material into the rock trench. This option does require the invert of the exfiltration trench pipe to be above the design high water elevation of the L-29 Canal, which is elevation 9.3 feet. As such, the profile of the roadway would need to be approximately 2 feet higher than for Alternative 2B - With Water Quality Treatment (Dry Retention Swales), or a centerline elevation of 16.0 feet.

The additional profile elevation affects the section width, but requires 17 to 27 feet less in width compared to Alternative 2B - With Water Quality Treatment (Dry Retention Swales), without and with stabilized side slopes respectively, for a net impact of 23 to 33 feet of wetland impact. This is in comparison to 50 feet of impact for the original Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Constructibility for this alternative would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B as discussed previously. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

The estimated cost for this alternative is $76,394,750 for the length of the corridor. This is a $17,844,100 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

Option 4: Wet Detention System

Utilizing a wet detention system requires the treatment of one inch of runoff from the contributing area in contrast to a dry retention system where the treatment volume is equal to 1/2 inch of runoff. It also requires a wider footprint than the dry retention swale design, due to the fact that the control elevation would be at the control elevation of the L-29 Canal rather than one foot above the control elevation. A minimum depth of 2 feet is proposed below the control elevation for deposition of sediments. Wet detention systems typically require a minimum width of 100 feet at the control elevation and an average depth between 6 and 8 feet which would require a wider footprint, thus impacting more wetland area. Proposing this type of a wet detention system would require a variance from the standard.

As depicted in the schematic in a narrow footprint, this option would require a distance of 55 feet beyond the edge of the shoulder for the swale as configured. The dry retention swale option as originally proposed requires 35 feet, so even if stabilized slopes were employed the wet retention option would still have slightly more impact as the dry retention technique. Alternative 2B - With Water Quality Treatment (Dry Retention Swales) has a 50 foot wetland impact with natural slope grading, and the wet detention technique with similar slope treatment would add 20 feet per swale, or 40 feet of impact, for a total impact of 90 feet.

The estimated cost for this alternative is essentially unchanged from the cost of Alternative 2B – With Water Quality Treatment (Dry Retention Swales), $58,550,650, since the change in fill areas associated with the swales is nearly the same.

Option 5: Single Dry Retention Swale System

In this option, there would be a dry retention swale on one side of the roadway. This single swale would retain the standard 5-foot width. Drainage from the side of the roadway without a swale would be channeled via a shoulder gutter and gutter inlets and piped under the roadway to the single dry detention swale.

To do this will require raising the roadway approximately 2.5 feet to accommodate an inlet, and a connecting pipe with a slope. While this eliminates a swale on the north side of the roadway, the swale on the south side of the road is approximately 0.5 feet deeper and the sideslopes of the roadway are wider due to the additional 2.5 feet of elevation. The net effect is that this footprint is 122 feet wide and that for Alternative 2B - With Water Quality Treatment (Dry Retention Swales) is 112 feet wide, for an increase of 10 feet of wetland impact. The wetland impact for this option is 60 feet, while that for Alternative 2B - With Water Quality Treatment (Dry Retention Swales) is 50 feet.

If the typical section were applied in a mirror image fashion, the result is similar.

This is because the new alignment must be offset from the canal by a minimum amount to accommodate maintenance of traffic requirements, and if the typical section is compressed sufficiently, then this maintenance of traffic criterion governs.

It is seen that the construction cost for this option would be slightly greater than Alternative 2B - With Water Quality Treatment (Dry Retention Swales) because of the stormwater piping and gutter system, and with a slight increase in wetland impact.

The estimated cost for this alternative is $67,015,550 for the length of the corridor. This is a $8,464,900 additive to the cost of Alternative 2B - With Water Quality Treatment (Dry Retention Swales).

3. Summary Evaluation of Potential "Creative" Water Quality Treatment Techniques for Alternative 2

Several "creative" water quality treatment strategies have been identified and reviewed. In summary, Options 1, 2 and 3 would reduce wetland impacts in comparison to Alternative 2 - With Water Quality Treatment (Dry Retention Swales), but at higher costs. Option 4 requires a wider footprint, a probable permitting exception, and will impact a greater area of wetlands. Option 5 has minimal advantage over Option 2 or 3, but would be slightly more costly. Options 1, 2, and 3 can be applied to Alternatives 6B, 7B, and 8B with the exception of the bridge structure sections of Alternatives 6B and 7B. The key characteristics of the various options are summarized in the following table:

Table 4
SUMMARY OF "CREATIVE" WATER QUALITY TREATMENT ALTERNATIVES

"Creative" Water Quality Treatment Alternative	*Feasibility Assessment*	*Cost Differential Relative to Alt. 2B - With Water Quality Treatment*	*Constructi-bility*	*Wetland Impacts to ENP*	*Applicability to Other Alternatives*	*Other Comments*
Option 1-A Shift North and Compress Swale With Wall Elements/ South Side (Alt. 2 C)	Technically feasible. Reduces wetland impacts. Relatively high cost.	+$73,663,600	Workable; centerline offset needed to execute MOT.	21 feet of impact versus 51 ft. for Alt. 2B.	Applicable.	Could reduce strikes on the road.
Option 1-B Shift North and Compress Swale With Wall Elements/ North Side (Alt. 2D)	Technically feasible. Reduces wetland impacts. Relatively high cost.	+$101,934,200	Workable; centerline offset needed to execute MOT.	No impact to ENP; affects L-29 canal.	Applicable.	Could reduce wildlife strikes on the road.
Option 1-C Shift North into L-29 Canal (Alt. 2E)	Technically feasible; reduces wetland impacts. Higher cost.	+$15,366,800	Workable; requires temporary wall.	No impact to ENP; affects L-29 canal.	Applicable.	None.
Option 2 Exfiltration Trench with Curb and Gutter	Technically feasible; reduces wetland impacts. Higher cost.	+$17,566,000	Workable; requires temporary wall.	Up to 33 feet of impact versus 51 ft. for Alt. 2B.	Applicable.	None.
Option 3 Exfiltration Trench with Shoulder Gutter	Technically feasible; reduces wetland impacts. Higher cost	+$17,844,100	Workable; requires temporary wall.	Up to 33 feet of impact versus 51 ft. for Alt. 2B.	Applicable.	None.
Option 4 Wet Detention System	Not feasible. Permitting exception needed. Same cost.	+$0	Workable; requires temporary wall.	90 feet of impact versus 51 ft. for Alt. 2B.	N/A	None.
Option 5 Single Swale Dry Detention System	Technically feasible, but no advantage over simpler options. Higher cost.	+$8,464,900	Feasible.	60 feet of impact versus 51 ft. for Alt. 2B.	Applicable.	None.

ENP = Everglades National Park

12. Alt. 2 Variation With Partial Water Quality Treatment

Information Request

Evaluate and develop a variation of Alternative #2 that includes partial WQT. Discuss both the benefits and the drawbacks of this possible alternative.

Additional Information

1. Approach to Partial Water Quality Treatment

This option proposes to utilize a five-foot wide grassed strip outside of the guardrail to the edge of a reinforced slope to provide a minimal treatment of surface water runoff. The option could possibly be utilized for the original Alternative 2A - Without Water Quality Treatment and Alternative 2B – With Water Quality Treatment (Dry Retention Swales).

The concept is to allow the runoff to sheet flow through this five-foot wide grass strip for pollutant uptake. A similar concept was utilized on the Howard Franklin Bridge Causeway in Tampa, where the Southwest Florida Water Management District (SWFWMD) approved this concept in lieu of a normal dry retention system.

2. Evaluation

The footprint for this alternative is 72.7 to 77.0 feet wide, with and without a stabilized side slope, respectively, and would encroach into wetlands to the south of the roadway by 11.0 to 15.0 feet with and without a stabilized side slope, respectively. Alternatively, a short wall system could be built into the L-29 Canal at additional cost, such that there would be no encroachment into the wetlands of Everglades National Park.

This option could be adapted to Alternative 2A but with some additional cost for additional fill area and costs associated with a slight shift in the alignment. There would be a wetland encroachment of 11.0 to 15.0 feet, depending if stabilized slopes were used. It is noted for reference that Alternative 2A does not rebuild the roadway embankment. Alternatively, the wetland encroachment could be avoided by encroaching into the L-29 Canal and building a short retaining wall or by building a retaining wall along the south right-of-way line. While these options were not priced out, they would be significantly more expensive due to the wall section the entire length of the corridor.

This option could be adapted to Alternative 2B which calls for rebuilding the roadway embankment. The dry retention swales would be removed and replaced by the grassed areas and stabilized side slopes on both sides of the roadway, and the

roadway built to the finish profile elevation of 14.0 feet. This footprint would be somewhat wider than the variation discussed above, and would likewise have wetland encroachment if the bank of the L-29 Canal was held as the north limit. Alternatively, if the south existing roadway slope limit was kept so that wetlands were unaffected, then a wall in the L-29 Canal would be required.

Constructibility for this option would require that the traffic lanes be shifted to the north and a temporary wall system be installed adjacent to this roadway on the south side. Then the remaining existing embankment on the south side would be removed and the new embankment installed up to the elevation of the existing road. The temporary wall system would be extended upward to permit the completion of a portion of the new roadway. Traffic would be shifted to the new roadway and the north portion of the roadway excavated and reconstructed up to finish profile. The new roadway section would then be completed and traffic shifted to the final configuration. This process would be generally similar to the construction method proposed for Options 1-A and 1-B as discussed previously. There is a cost premium associated with this scheme because of the roadway elevation differentials and the need for the temporary wall.

13. Shift Alt. 2 into the L-29 Canal and Avoid ENP Wetlands

Information Request

Evaluate moving the alignment for Alternative #2 with WQT into the L-29 canal so that there will be no wetland impacts. This conceptual level evaluation should consider potential construction methods and order of magnitude costs for filling the canal. Since this is an authorized project, the hydraulic capacity of the canal cannot be decreased. Therefore, if a portion of the canal is filled, additional excavation must be done to offset the loss of capacity. In addition to the evaluation, additional costs or construction constraints should also be identified (i.e. utility relocation, complexity of construction, potential access problems on the North side of the canal, impacts to the Tiger Tail camp, etc).

Additional Information

1. Background

Because of concerns regarding encroachment into wetlands south of the existing Tamiami Trail, the possibility of modifying the configuration and placement of the typical section to minimize or eliminate this encroachment was identified. The initial concept envisioned was to simply shift northward the second variation of Alternative 2, that is Alternative 2B – With Water Quality Treatment (Dry Retention Swales). Such displacement would encroach into the L-29 Canal. It has been further

determined that the canal shape is the minimum required for its hydraulic conveyance function, so that any encroachment into the canal from the south bank should be compensated by the excavation of the canal by a like area.

Exploration of this approach led to the identification of a variation involving the use of vertical walls to reduce the width of the dry detention swale. Further review of this concept led to the development of two different applications of the vertical wall treatment. Since they have relevance to the formulation of "creative" water quality treatment options as addressed in Topic 1 in this report previously, a description of them was contained in that section of the report. They are referred to in that section as Option 1-A (Alt. 2C) and Option 1-B (Alt. 2D). The concept of shifting the original of Alternative 2B – With Water Quality Treatment (Dry Retention Swales) northward into the canal is considered in that section as well, and is referred to as Option 1-C (Alt. 2E).

2. Summary

The key features of this strategy as characterized in the three options noted above, Options 1-A, 1-B, and 1-C, are summarized in Section 24 of this report.

14. Removal Of Existing Road Paving And Subgrade

Information Request

Determine the cost of removing, to the extent possible, the existing roadbed and subgrade for all alternatives which effectively "abandon" the existing Tamiami Trail. The purpose of this exercise is to evaluate the cost of removing impermeable surface that may contribute to runoff requiring additional WQT.

Additional Information

1. Background

The concept of removing the existing pavement and subgrade to compensate for new pavement areas is not viable for Alternatives 8A and 8B, since the existing pavement continues to carry traffic or is not left in place. The removal is also not viable for Alts. 7A and 7B since the embankment needs to be removed to provide for hydraulic flow capacity. The removal of pavement is viable for the sections adjacent to the bridge elements which are a part of Alts. 6A and 6B. For Alt. 6B, it is noted that "islands" of embankment 600 feet in length for dry retention facilities will remain even if the balance of the pavement or embankment is removed.

To reiterate, this concept entails the removal of any impervious asphaltic pavement

in the upper roadway section down to the level of the subgrade comprised of limerock and similar materials which are pervious. Results are summarized in Table 5 and include prior alternatives for reference. It is first noted, however, that the regulatory agencies do not typically require the removal of old pavement if traffic is prevented from utilizing the abandoned roadway. Pollutants are primarily a result of motor vehicles, with only a minor contribution historically from roadway materials.

Table 5
SUMMARY OF PAVEMENT REMOVAL

Alternative	**Applicability of Pavement Removal To This Alternative**	**Cost of Removal**
Alternative 1 Existing Alignment / Same Profile	NO	N/A
Alternative 2A Existing Alignment Without WQT	NO	N/A
Alternative 2B Existing Alignment With WQT	NO	N/A
Alternative 3A North Alignment Without WQT	YES	$1,672,800
Alternative 3B North Alignment With WQT	YES	$1,672,800
Alternative 4A South Alignment Without WQT	YES	$1,668,400
Alternative 4B South Alignment With WQT	YES	$1,702,200
Alternative 5A Structure Without WQT	YES	$ 460,400
Alternative 5B Structure With WQT	YES	$ 348,900
Alternative 6A Existing Alignment With 4-Mile Bridge Without WQT	YES Adjacent to bridge.	$ 623,300
Alternative 6B Existing Alignment With 4-Mile Bridge With WQT	YES Adjacent to bridge less WQT.	$ 467,500
Alternative 7A Existing Alignment With 3,000-Foot Bridge Without WQT	NO	N/A
Alternative 7B Existing Alignment With 3,000-Foot Bridge With WQT	NO	N/A
Alternative 8A* Existing Alignment With 24 New + Existing Culverts Without WQT	NO	N/A
Alternative 8B Existing Alignment With 40 New Culverts With WQT	NO	N/A

WQT = Water Quality Treatment with Dry Retention Swales

15. Impact Of Exceeding CERP-Authorized Operational Flow of 5,500 CFS

Information Request

Discuss, on a conceptual basis, how future operational changes could impact to each alternative and what changes, including costs, might be required. To do this, water stages associated with a hypothetical increase in flow will be provided by the Government.

Additional Information

1. Background

This topic addresses two hypothetical water management operational scenarios related to potential future conditions in the Tamiami Trail corridor under the Comprehensive Everglades Restoration Plan (CERP). The Modified Water Deliveries Program has been developed on the basis of a 4,000 cfs flow rate across the section of the Tamiami Trail covered by this project. In hydraulic modeling including the proposed four bridges along Tamiami Trail, this condition yielded a stage elevation in the L-29 Canal previously of 9.0 feet (NDVD 29) for a 100-year event, and as the result of a recent model update, the current design high water elevation of 9.3 feet.

The flow scenario designated for review has a flow rate of 5,500 cfs for Tamiami Trail as proposed with four new bridges, which has a resulting L-29 Canal stage elevation of 9.58 feet (NVGD 29), or nominally 9.6 feet, for an increase of 0.3 feet. A second hypothetical flow scenario would have a flow rate of 10,000 cfs with a resulting L-29 Canal stage of 10.45 feet (NGVD 29), or nominally 10.5 feet, for an increase of 1.2 feet. Originally, a second hypothetical scenario adding two additional bridges to the four new bridges was to be discussed. However, hydraulic modeling yielded results nearly identical to those for the first scenario, because of backwater conditions. As a result, no discussion of this second scenario is provided.

It is noted that for a hypothetical CERP flow of 10,000 cfs, Alts. 6A, 7A, and 8A would not be feasible, as they cannot be practically raised further to accommodate the total elevation change needed to keep maintain a dry roadway subgrade.

Based on comments provided by participating agencies in the development of this project, this analysis has been conducted to identify the project's operational flexibility should there be an occasion when the authorized CERP flows are exceeded. USACE does not anticipate that CERP flows will be exceeded, but agreed to include the analysis for operational flexibility.

2. Scenario 1: 5,500 cfs Flow Rate (With 4 Bridges)

In this scenario, the critical water elevation would be 0.3 feet higher than the design high water of 9.3 feet for the alternatives. This differential would not affect the viability of any alternatives, and all alternatives would be compatible with this CERP flow rate, except for Alternative 1 which experiences water subgrade issues at the design high water elevation. Again, all other alternatives would be compatible with the CERP flow rate of 5,500 cfs.

3. Scenario 2: 10,000 cfs Flow Rate (With 4 Bridges)

In this scenario, the alternatives would need to be raised 1.2 feet to accommodate an increased Design High Water elevation of 10.5 feet. As noted, Alternatives 6A, 7A, and 8A - all Without Water Quality Treatment - could not be modified to address this change and are therefore infeasible under this scenario.

Alternatives 6B, 7B, and 8B would all need to have the finished roadway and structure elevations raised 1.2 feet to satisfy the increased Design High Water elevation criterion. This would be done by increasing the depth of the embankment under the roadway and by raising the structures slightly. This will have the effect of increasing the width of the typical section for these alternatives by about 6 feet. For all these alternatives as originally defined, this would translate into an additional wetland impact of 6 feet as well, as defined by the intersection of the toe of slope with existing ground elevation.

In addition, while not a part of this project, this elevation would affect the previously relocated Tiger Tail Indian Camp, the Osceola Indian Camp, the recreation area near the east end of the corridor, and the Airboat Association of Florida site. These would require raising of the site elevation, and modification of access roads to serve each one as well.

These impacts are associated solely with the increased water levels. Should the L-29 Levee and L-29 Canal be degraded, different access arrangements for each site would be necessary, assuming they remained in the corridor at a suitable site elevation.

Cost estimates were developed for the adjustments to the alternatives for the increased water elevation, excluding site and access impacts to the noted land uses.

For sections of Alternative 6 and 7 on structure, the structure for both the situations with and without water quality treatment would require the bridge deck elevation to be raised 1.2 feet as for the embankment sections. In addition, the alternative with

water quality treatment would require additional work to raise the elevation of the dry detention swales to be built on segments of the remnant existing embankment. These swales could be raised using additional adjacent embankment material.

Costs estimates for the affected alternatives are presented in the Summary section of this topic discussion.

4. Summary

All of the alternatives, except for Alternative 1, are compatible with the 5,500 cfs CERP flow rate.

For the 10,000 cfs flow rate, which is hypothetical, the impact would be to require raising the profile of the corridor alternatives With Water Quality Treatment by 1.2 feet to accommodate the increased design high water elevation. The corridor alternatives Without Water Quality Treatment cannot be raised this much and are therefore infeasible under this condition. There would be a corresponding increase in the width of the improvement for these alternatives as well. The cost of the added fill for Alternatives 6B, 7B and 8B, which have similar typical section widths, ranges from $970,000 to $1.54 million. The cost to raise structures is considered negligible as piles will simply be cut off at a higher finish elevation. The results of this review are summarized in the following table, and include prior alternatives for reference.

Table 6
IMPACT OF EXCEEDING CERP-AUTHORIZED OPERATIONAL FLOWS OF 5,500 CFS

Alternative WQT = Water Quality Treatment with Dry Retention Facilities	**Effect of the 5,500 cfs Flow Rate on Alternative**	**Effect of the 10,000 cfs Flow Rate on Alternative**		
		Feasibility	**Wetland Impact of Modification to Alternative**	**Added Cost To Raise Alignments**
Alternative 1 Existing Alignment / Same Profile	*Alternative not feasible.*	*Alternative not feasible. Cannot be raised.*	N/A	N/A
Alternative 2A Existing Alignment Without WQT	No adjustment needed. Compatible as is.	*Alternative not feasible. Cannot be raised.*	N/A	N/A
Alternative 2B Existing Alignment With WQT	No adjustment needed. Compatible as is.	Roadway and structure elevation must be raised.	Section will be 6 ft. wider, with added wetland impact.	$1,490,700
Alternative 3A North Alignment Without WQT	No adjustment needed. Compatible as is.	No adjustment needed .		$ 0
Alternative 3B North Alignment With WQT	No adjustment needed.	No adjustment needed.		$ 0
Alternative 4A South Alignment Without WQT	No adjustment needed. Compatible as is.	Roadway and structure elevation must be raised.	Section will be 6 ft. wider, with added wetland impact.	$ 1,345,000
Alternative 4B South Alignment With WQT	No adjustment needed. Compatible as is.	Roadway and structure elevation must be raised.	Section will be 6 ft. wider, with added wetland impact.	$ 1,759,200
Alternative 5A Structure Without WQT	No adjustment needed. Compatible as is.	Roadway and structure elevation must be raised.	Minor impact as alignment is on structure.	$ 0
Alternative 5B Structure With WQT	No adjustment needed. Compatible as is.	Detention swales and structure elevation must be raised.	Minor impact as alignment is on structure.	$ 320,000
Alternative 6A Existing Alignment 4-Mile Bridge Without WQT	No adjustment needed.	*Alternative not feasible. Cannot be raised.*	N/A	N/A
Alternative 6B Existing Alignment 4-Mile Bridge With WQT	No adjustment needed. Compatible as is.	Roadway and structure elevation must be raised.	Embankment section will be 6 ft. wider, with added wetland impact.	**$ 970,000**
Alternative 7A Existing Alignment3,000-Ft Bridge Without WQT	No adjustment needed. Compatible as is.	*Alternative not feasible. Cannot be raised.*	N/A	N/A

Alternative 7B Existing Alignment 3,000-Foot Bridge With WQT	No adjustment needed. Compatible as is.	Roadway and structure elevation must be raised.	Embankment section will be 6 ft. wider, with added wetland impact.	**$1,450,000**
Alternative 8A Existing Alignment 24 New + Existing Culverts Without WQT	No adjustment needed. Compatible as is.	*Alternative not feasible. Cannot be raised.*	N/A	N/A
Alternative 8B Existing Alignment 40 New Culverts With WQT	No adjustment needed.	Roadway elevation must be raised.	Embankment section will be 6 ft. wider, with added wetland impact.	**$1,540,000**

16. Compatibility Of Alternatives To CERP

Information Request

Discuss how each alternative is compatible, or can be made compatible, with the goals of the CERP plan (passing the increased flow difference between Modified Water Deliveries of 4,000 cfs and the CERP flows of 5,500 cfs, promoting the decompartmentalization of Water Conservation Area 3 and the Everglades, ecological connectivity, and improved sheet flow throughout the system).

Additional Information

1. Background on CERP

Related CERP modifications are authorized, but construction funds cannot be appropriated until the completion of Modified Water Deliveries per WRDA 2000. It is appropriate that the Comprehensive Review Study for the Comprehensive Everglades Restoration Plan (CERP) has identified the potential for additional modifications to water management facilities over and above those contemplated under the Modified Water Deliveries program. While the additional CERP modifications are not yet authorized, it is appropriate to consider the relation of these potential projects with the alternatives being considered for the modification of Tamiami Trail.

The Comprehensive Review Study has identified several projects relating to Water Conservation Area 3 in the Eastern Everglades. Of specific relevance to the Tamiami Trail corridor is one specific project relating to “decompartmentalization” of water management basins and enhancement of sheetflow. This project includes the conceptual plan to degrade the L-29 levee and L-29 borrow canal to restore sheetflow and ecological connectivity, as well as raise and bridge this eastern portion of Tamiami Trail.

The Project Implementation Report for CERP will address the scope and method to be used for this and other related projects. The same report will address the sequencing of the various additional proposed modifications.

According to the Comprehensive Review Study, this modification and several others will have the effect of providing "the initial increment of more integrated passive management of Water Conservation Area 3 and Everglades National Park. It is anticipated that these modifications will be made in association with the implementation of rainfall driven operational schedules for both Water Conservation Area 3 and Everglades National Park."

"The benefits to the project from this feature are that restoring sheet flow will reduce the unnatural discontinuities in the landscape. Depth patterns will be more gradual, aquatic organisms will be able to move more freely, exotic species will not have the advantage of deep water canals that provide thermal refuge or dry levees on which to grow. Normal proportions of predators/prey species in fish populations will be undisturbed. Natural interspersions of different marsh habitats will replace the current system of upstream pools and downstream dry area on either side of barriers. The result will be better quality and more easily accessible habitat for wading birds and other Everglades species."

2. Impact of increasing Flows Up To CERP-Authorized Flows of 5,500 CFS

The scenario of increased water flow was discussed in the preceding topic. Under the flow rate of 5,500 cfs, all alternatives (except Alternative 1) would be compatible with the CERP flow rate and would not require any adjustments.

3. Impact of Exceeding CERP Authorized Operational Flows of 5,500 CFS

Under the hypothetical flow of 10,000 cfs, the 100-year stage elevation would be nominally 10.5 feet, which would require alternatives to be raised by 1.2 feet to keep the roadway subgrade in the dry. The embankment sections of Alternatives 6A, 7A, and 8A – all Without Water Quality Treatment - are not amenable to such a large change in profile grade, and thus are not compatible with the increased flow scenario. The remaining alternatives, Alternatives 6B, 7B, and 8B could be raised in their design to accommodate the higher Design High Water condition. The costs of doing so were noted previously as well. There is also an incremental wetland impact of raising the alternatives on embankment sections of approximately 6 feet.

It is also noted that the Tiger Tail and Osceola Indian Camps, the Airboat Association of Florida site, and the eastern recreational area and their access provisions would also be affected by this increased water elevation. These sites would need to be raised and their access routes modified as well.

It is presumed that, should the hypothetical 10,000 cfs flow rate actually be implemented, the alternatives would be designed accordingly prior to construction to conform to this design condition. To attempt to retrofit alternatives developed for the Modified Water Deliveries program once constructed to function under this hypothetical CERP flow condition would be very costly due to construction phasing and maintenance of traffic considerations, with potential temporary wetland impacts.

A variation of this approach would be if Alternative 6A, 7A or 8A – all Without Water Quality Treatment - were built first, then the embankment sections abandoned after further bridge segments or a typical section with Water Quality Treatment were built. The original improvement would in this case be considered a "throwaway" cost, expended for the benefit of providing less expensive, but immediate conformance with short-term flow requirements while deferring somewhat the time line for more expensive permanent improvements that would be CERP-compatible.

4. Increased Sheet Flow

For this discussion, it is assumed that decompartmentalization is implemented, such that the L-29 Canal and Levee are degraded where possible, and that remnant sections of the existing Tamiami Trail embankment would be degraded as well.

As defined, Alternatives 6, 7, and 8 employ embankment typical sections along all or part of their alignment, using some combination of bridges and box culverts to convey the Modified Water Deliveries program flows. It is noted that Alternatives 6A, 7A, and 8A are functional at the 5,500 cfs flow rate, but are not feasible at the 10,000 cfs flow rate because they cannot be raised to satisfy the hypothetical CERP flow scenario. Increase sheetflow is not a function of flow rate but rather of the extent of openings along the corridor.

For Alternatives 6B, 7B, and 8B, the continuous sheet flow along the 11-mile corridor will be affected by the extent of bridge openings. Alternative 8 has no bridges and thus none of the corridor embankment is available to facilitate sheet flow. Alternative 7 would be somewhat better (5% of corridor embankment with bridge opening) in dispersing water flows through its embankment, and Alternative 6A with its 4-mile bridge provides 27% of the corridor for sheet flow movement. Alternative 6B –With Water Quality Treatment (Dry Detention Swales) as defined would utilize short (600-foot long) segments of the existing roadway embankment, retrofitted as dry detention cells. These would occur once every _ mile, such that approximately 25% of the bridge corridor would be blocked by these "islands" for water quality treatment.

5. Decompartmentalization

Under the CERP conceptual plan, the degradation of the L-29 Canal and Levee

would occur. For the purposes of this discussion, it is presumed that remnant portions of the existing Tamiami Trail roadway embankment unutilized by a specific roadway improvement alternative would also be degraded. It is also presumed that the alternative would have been raised to meet the CERP flow conditions.

Under Alternatives 6B, 7B, and 8B all of the existing roadway embankment would be removed as these alternatives reconstruct the embankment. In these sections, decompartmentalization would address therefore the L-29 Levee and Canal only, leaving the respective alternative as the remaining built facility in the corridor. It is noted that prior to decompartmentalization that for alternatives with lengthy bridge sections that portions of the existing Tamiami Trail may need to remain in place as long as the L-29 Canal were to provide an east-west water conveyance function.

Under Alternative 6A, which has a 4-mile bridge structure, decompartmentalization would address in the section with the bridge therefore the L-29 Levee and Canal, and the remnant embankment of the existing Tamiami Trail roadway as well, leaving the structure as the remaining built facility in this section of the corridor. For Alternative 6B, “islands” of the existing roadway embankment would remain along the bridge segment for water quality treatment in the form of dry retention swales. Under Alternative 7A and 7B, the length of the bridge is set for hydraulic capacity so that the embankment should be removed initially. The bridge is short enough that under Alternative 7B – With Water Quality Treatment, the runoff can be piped to either end of the bridge.

It is noted that in the process of decompartmentalization, another issue is the fate of the existing Indian camps, the airboat club, and the eastern recreational area. If they were to remain, each would have to be raised and their access modified as well.

Recreational opportunities would be restricted to access points at either end of the 11-mile corridor, unless other provisions were made.

The degrading of the L-29 Canal, the L-29 Levee and remnant sections of the existing Tamiami Trail embankment have not been quantified as a construction project. Presumably certain embankment materials could be used to fill in the L-29 Canal, reducing the quantity of spoil material and the cost associated with hauling and disposing of it. Excess or unsuitable materials would likely be hauled on the existing road eastward past Krome Avenue to a deposition site. There would be work zone, staging area, and construction traffic issues associated with this removal effort. Sequencing may be critical as well; for example, it may be sensible to start at the west end of the corridor and work eastward. Control of turbidity would likely be a special issue during the removal work.

There will also be issues of right-of-way conveyance as US 41 is operated by the

Florida DOT. Other agencies have right-of-way, easement, or lease interests in the corridor which would likewise have to be resolved.

6. Ecological Connectivity

The present roadway embankment has the L-29 Canal to the north, wetlands to the south, and numerous culverts which pass water from north to south under the roadway. North of the L-29 Canal is the L-29 Levee. These facilities may inhibit the free movement of mammals, amphibians and aquatic species, or contribute to road strikes for some populations.

The proposed corridor improvement alternatives will all introduce new bridge structures which will afford enhanced opportunities for the movement of a wide range of species. Without the degrading of the L-29 Canal and the adjacent levee with its existing and proposed water control structures, movement would still be somewhat restricted.

With the additional effects of decompartmentalization, the impediments of the levee and canal would be removed, leaving the improved roadway corridor. Only Alternatives 6A, 6B, 7A and 7B would have bridge structures to pass water flows which would also be available for movement of various species, to varying degrees depending on water levels and the extent of openings provided by the alternatives. These openings range from the 4-mile bridge for Alternatives 6A and 6B to the 3,000-foot bridges for Alternatives 7A and 7B, while Alternatives 8A and 8B have no bridges.

For all three additional alternatives, undercrossings through the embankment could also be provided. These are essentially box culverts or bridges of appropriate dimensions to permit and encourage specified species to pass under the roadway. The spacing of these would depend on the quantity of movement and the patterns, but perhaps one per mile where there are no bridges would be a suitable spacing. The dimension of the structure would also dictate the effect if any on the roadway profile. It is likely that the height of the undercrossing in relation to the road profile for either the Modified Water Deliveries or the CERP 5,500 cfs design elevations would be such that an adjustment to the roadway profile would be not be required, with three exceptions.

There are several instances of special provisions along roadway corridors for the movement of wildlife. These include a 2 mile section of US 441 near Gainesville, and the I-75/Alligator Alley corridor in South Florida. Similar accommodations have been incorporated into the proposed improvements to US 1 between Homestead and Key Largo.

For example, the US 441 segment was thought to have the highest incident of

mortality in the state. Thousands of animals from more than 80 species have been killed annually. In 1997, a multidisciplinary group representing transportation agencies, natural resource agencies, environmental groups, and the University of Florida brainstormed solutions to mitigate the losses and help restore natural movement patterns. The result was a 3 1/2-foot-high wall with a lip at the top similar to those in zoo serpentariums. The intent was to deter climbing and jumping animals from entering the road corridor. These animals would instead be channelled by the wall to available undercrossings. FDOT began construction in December 1999.

On the I-75 corridor, several animal undercrossings were provided in addition to hydraulic culverts. In this case, continuous fencing with mesh was installed on both sides of the roadway to divert animals to the undercrossing locations.

It would be possible to incorporate such features in the initial construction, or added later. In the latter case, detours within the existing road section or lane closures should permit adequate work area to permit construction of the undercrossings.

7. Summary Evaluation

The results of this review are summarized in the following table:

Table 7
SUMMARY OF COMPATIBILITY OF ALTERNATIVES TO CERP

Corridor Roadway Alternative	***CERP COMPONENT***				
	Increased Flows		***Increased Sheet Flow***	***Decompart-mentalization***	***Ecological Connection (See also "Increased Sh Flow")***
	Increasing to 5,500 cfs Flow Rate	***Increasing to 10,000 cfs Flow Rate***			
Alternative 6A Existing Alignment 4-Mile Bridge Without WQT	Compatible. No adjustments needed.	*Alternative not compatible. Embankment section cannot be raised.*	Single bridge provides 36% opening along corridor.	Compatible. Removes levee, canal; in addition, removes abandoned existing roadway adjacent to bridge section.	Moderate connectivity. Animal undercrossings would improve alternative.
Alternative 6B Existing Alignment 4-Mile Bridge With WQT	Compatible. No adjustments needed.	Roadway and structure elevation must be raised. Incremental + 6 ft. wetland impact in embankment sections. **Added cost of $970,000.**	Single bridge and detention swales provide 27% opening along corridor.	Compatible. Removes levee, canal; in addition, removes abandoned existing roadway adjacent to bridge section.	Moderate connectivity. Animal undercrossings would improve alternative.
Alternative 7A Existing Alignment 3,000-Foot Bridge Without WQT	Compatible. No adjustments needed.	*Alternative not compatible. Embankment section cannot be raised.*	Single bridge provides 5% opening along corridor.	Compatible. Removes levee and canal.	Limited connecti Animal undercrossings would be needec
Alternative 7B Existing Alignment 3,000-Foot Bridge With WQT	Compatible. No adjustments needed.	Roadway and structure elevation must be raised. Incremental + 6 ft. wetland impact in embankment sections. **Added cost of $1,450,000.**	Single bridge provides 5% opening along corridor.	Compatible. Removes levee and canal.	Limited connecti Animal undercrossings would be needec
Alternative 8A Existing Alignment 24 New + Existing Culverts Without WQT	Compatible. No adjustments needed.	*Alternative not compatible. Embankment section cannot be raised.*	No bridges; 0% opening along corridor.	Compatible. Removes levee and canal.	No connectivity. Animal undercrossings would be needec

Corridor Roadway Alternative	*CERP COMPONENT*				
	Increased Flows		*Increased Sheet Flow*	*Decompart-mentalization*	*Ecological Connection (See also "Increased Sh Flow")*
	Increasing to 5,500 cfs Flow Rate	*Increasing to 10,000 cfs Flow Rate*			
Alternative 8B Existing Alignment 40 New Culverts With WQT	Compatible. No adjustments needed.	Roadway elevation must be raised. Incremental + 6 ft. wetland impact in embankment sections. **Added cost of $1,540,000.**	No bridges; 0% opening along corridor.	Compatible. Removes levee and canal.	No connectivity. Animal undercrossings would be needed

17. Cost Of Expediting Construction Schedule For Alternatives 6 To 8

Information Request

Determine the cost for expediting construction for Alternatives 6 through 8.

Response

1. Definition of Expedited Construction

The base cost estimates for alternatives were developed assuming standard or routine construction resources and methods. However, there is concern that requirements for increased water flows in the near term may necessitate the expediting of construction in order to accommodate those increased flows. As a result, each alternative was reviewed in this regard, and a second estimate developed to reflect an acceleration of the construction.

The basic adjustment made was to increase the availability of additional construction staffing and in the associated administrative costs. The achievement of the accelerated schedule will, of course, be dependent upon the actual availability of this construction staffing and in the timely delivery of required construction materials and products.

2. Summary of Alternatives Cost with Expedited Construction

The results of this analysis are summarized in the following table.

Table 8
SUMMARY OF EXPEDITED CONSTRUCTION

Alternative	Standard Construction		Expedited Construction		Added Cost
	Timeline (months)	Cost (millions)	Timeline (months)	Cost (millions)	Cost (millions)
Alternative 6A Existing Alignment With 4-Mile Bridge *Without WQT*	30	$72.2	20	$83.0	$10.8
Alternative 6B Existing Alignment With 4-Mile Bridge *With WQT*	30	$80.1	20	$92.1	$12.0
Alternative 7A Existing Alignment With 3,000-Foot Bridge *Without WQT*	24	$23.3	16	$26.8	$3.5
Alternative 7B Existing Alignment With 3,000-Foot Bridge *With WQT*	24	$50.5	16	$58.3	$7.6
Alternative 8A Existing Alignment With Box Culverts *Without WQT* • **24 New and 55 Existing**	24	$44.3	16	$50.9	$6.6
Alternative 8B Existing Alignment With Box Culverts *With WQT* • **40 New and No Existing**	28	$96.4	18	$110.8	$14.4

WQT = Water Quality Treatment with Dry Retention Swales

3. Impact on Construction Duration If the Road is Not Resurfaced for Alternatives Without Water Quality Treatment

This matter was investigated in response to a comment received. The question is if pavement overbuilding was not needed for the "Without Water Quality Treatment" alternatives, would the construction schedule be reduced. The following list summarizes the results of this review:

Alternative	Schedule Reduction	Comments
1	Not applicable	Project requires resurfacing
2A	0 months	Bridges drive schedule
3A	Not applicable	New alignment

4A	Not applicable	New alignment
5A	Not applicable	Little roadway; existing profile not retained
6A	0 months	Bridge drives schedule
7A	0 months	Bridge drives schedule
8A	2-3 months	No bridges; culverts do not drive schedule

I. ADDITIONAL FEATURES ANALYZED

18. Complete Removal of the Existing Roadway (For Alternative 5)

In order to evaluate the cost of full decompartmentalization, a conceptual level cost for completely removing the existing embankment abandoned as part of Alternative 5 was calculated. This cost is computed separately for Alternatives 5A and 5B. For this analysis, a haul distance of 20 miles was assumed from the intersection of US 41 at Krome Avenue. It was also assumed that the embankment will be removed to the same elevation as the surrounding marsh. This yields a cross-sectional embankment area of 225 square feet per centerline foot for the existing embankment. The average length of haul within the 11 mile corridor is 5.5 miles, plus 1 mile from the east end of the corridor to Krome Avenue, the haul reference point; thus the total haul length is 26.5 miles. The estimated haul cost for this trip length is approximately $14/cubic yard.

The cost for Alternative 5 embankment removal is estimated as follows:

Alt. 5A - Without Water Quality Treatment:

- Length of embankment to be removed = 53,500 lineal feet
- Estimated cost to remove = $6,241,700

Alt. 5B - With Water Quality Treatment:

- Length of embankment to be removed = 42,500 lineal feet
- Estimated cost to remove = $4,958,300

For the quantities of embankment removal that are a part of the defined alternatives, excavation and hauling was assumed to fall within a short distance within the project with reuse of the excavated material. The cost for Alt. 5B is less as a portion of the embankment would remain in place in the form of dry retention facilities for water quality treatment.

19. Incremental Costs

It has been noted that many of the optional features that can be applied to the various alternatives can be done so at a range of scales, such that the evaluation of the incremental construction costs for the various features is a useful tool. Although such incremental costs are conceptual in nature and will only be used for planning purposes. This information can generally be derived from cost data already

developed. The information will be developed for three cost elements: roadway embankment removal, wildlife barriers, and causeway bridge construction.

A. Roadway Embankment Removal

This element consists of the removal of the existing roadway embankment, where it has not already been removed for construction of the alternative roadway embankment or structure if included, or to create breaches for water flow. Likewise, it is noted that some portions of the embankment would remain for alternatives with long structures for the water quality treatment option where portions of the embankment are left as islands for dry retention facilities. The cost of embankment removal by alternative are summarized in Table 9. Prior alternatives are included for reference.

Table 9
EXISTING EMBANKMENT REMOVAL COSTS

Alternative	**Length of Remaining Embankment Available for Removal**	**Cost to Remove Remaining Existing Embankment**
Alternative 1 Existing Alignment with 4 New Bridges Without WQT	None.	N/A
Alternative 2A Existing Alignment and Raised Profile with 4 New Bridges Without WQT	None.	N/A
Alternative 2B Existing Alignment and Raised Profile with 4 New Bridges With WQT	None.	N/A
Alternative 3A North Alignment with 4 New Bridges Without WQT	48,300 lineal feet	**$5,635,200**
Alternative 3B North Alignment with 4 New Bridges Without WQT	48,300 lineal feet	**$5,635,200**
Alternative 4A South Alignment with 4 New Bridges Without WQT	53,500 lineal feet *Note: Only about 50% of existing embankment width would be remaining.*	**$3,120,850**
Alternative 4B South Alignment with 4 New Bridges With WQT	53,500 lineal feet *Note: Only about 50% of existing embankment width would be remaining.*	**$3,120,850**
Alternative 5A Raised Profile on Structure Without WQT	53,500 lineal feet	**$6,241,700**
Alternative 5B Raised Profile on Structure With WQT	42,500 lineal feet	**$4,958,300**
Alternative 6A Existing Alignment with 4-Mile Bridge Without WQT	19,700 lineal feet	**$2,298,300**
Alternative 6B Existing Alignment with 4-Mile Bridge With WQT	15,500 lineal feet	**$1,808,300**
Alternative 7A Existing Alignment with 3,000-Foot Bridge Without WQT	None. *Removed as part of initial construction.*	N/A

Alternative 7B Existing Alignment with 3,000-Foot Bridge With WQT	None. *Removed as part of initial construction.*	N/A
Alternative 8A Existing Alignment; 24 New + Existing Culverts Without WQT	None.	N/A
Alternative 8B Existing Alignment; 40 New Culverts With WQT	None.	N/A

WQT = Water Quality Treatment with Dry Retention Swales

From a unit price standpoint, the variation in cost as a function of quantity installed is relatively insensitive to the large quantity levels considered in the table.

B. Wildlife Barriers

This element consists of the installation of a special wildlife barrier along both sides of the proposed roadway embankment sections of the various alternatives. This analysis identifies the incremental cost of constructing the barriers as a function of how much of the barrier is built, beginning with minimum length of 1,000 lineal feet.

The estimated cost for the wildlife barrier feature is $124.48 per lineal foot. This unit price is relatively constant for changes in quantity because of the relatively large level of quantities involved in this project.

C. Causeway Bridge Construction

This element consists of the construction of the causeway bridge configuration for the corridor, as ultimately represented by Alternative 5 which extends for nearly the entire length of the corridor. This analysis identifies the incremental cost of constructing the bridge as a function of how much of the bridge is built, beginning with minimum length of 2,000 lineal feet.

The estimated cost for the vehicular bridge element is $12,100,000 per mile of bridge length, $2,292 per per lineal foot of bridge deck, or $53.20 per square foot. This unit price is relatively constant for changes in quantity because of the relatively large level of quantities involved in this project..

20. Duplication of Cost Analysis For Subsequent Modification of Alternatives to Alternative 5

As part of the CERP, the decompartmentalization project may expand upon, add to, or replace some of the modifications made to Tamiami Trail. This analysis assumes that Alternative 5 represents full decompartmentalization of Tamiami Trail, and

identifies costs associated with Alternatives 6 and 7 that would be lost or duplicated if these alternatives were modified in the future to expand those alternatives to an Alternative 5 configuration.

Decompartmentalization is scheduled to begin in October 2001, and a complete analysis of alternatives will be performed. A variety of alternatives will be evaluated and could include a series of bridges as well as Alt. 5C. If a series of breiges is the selected alternative for CERP decompartmentalization, then the cost duplication described in this section will not apply.

As summarized in Table 10, the cost ranges from over $25 million for Alt. 6A to over $45 million for Alt. 7B. Building a longer bridge initially reduces the amount of embankment improvements, which are a duplicated cost if the bridge is built the entire length. Any new culvert work also falls into this category, as do wildlife features, which are not included in the table, but would typically add from $13 to $21 million depending on the alternative. It is noted that if an initially bridge section is not built with one end in an ultimate location for a bridge terminus, then it will be necessary to build two temporary connections from the roadway embankment to the bridge some short distance from the bridge ends, so that the bridge can be extended in either direction. While not costed in detail, it is estimated that this temporary connection would cost at least $1 million each. This suggests that, all other things being equal, that one terminus of any long bridge built under an initial phase be located at a permanent bridge end location.

Table 10

DUPLICATION OF COST ANALYSIS FOR SUBSEQUENT MODIFICATION OF ALTERNATIVES TO ALTERNATIVE 5

ALTERNATIVE	Value of Initially Built Improvements Not Salvaged	Removal of Initially Built Improvements Not Salvaged	Removal of Remnant Existing Road Embankment	New Construction	Other Elements	Notes for Other Elements	TOTAL
1- No Water Quality Treatment	$14.8	$6.9	$0.0	$135.9	$0.0		**$157.6**
2A - No Water Quality Treatment	$24.3	$7.8	$0.0	$135.9	$0.0		**$168.0**
2B - Water Quality Treatment	$58.5	$18.0	$0.0	$140.3	$0.0		**$216.8**
3A - No Water Quality Treatment	$67.9	$15.6	$5.6	$135.9	$0.0		**$225.0**
3B - Water Quality Treatment	$73.4	$19.6	$5.6	$140.3	$0.0		**$238.9**
4A - No Water Quality Treatment	$45.2	$18.0	$3.1	$135.9	$0.0		**$202.2**
4B - Water Quality Treatment	$47.1	$18.0	$3.1	$140.3	$0.0		**$208.5**
5A - No Water Quality Treatment	$0.0	$0.0	$6.2	$0.0	$0.0		**$6.2**
5B - Water Quality Treatment	$0.0	$0.0	$5.0	$0.0	$0.0		**$5.0**
6A - No Water Quality Treatment	$22.8	$4.4	$2.3	$76.5	$2.0	2 temporary bridge connections	**$108.0**
6B - Water Quality Treatment	$42.0	$11.0	$1.8	$80.9	$2.0	2 temporary bridge connections	**$137.7**
7A - No Water Quality Treatment	$16.1	$6.6	$0.0	$129.0	$2.0	2 temporary bridge connections	**$153.7**
7B - Water Quality Treatment	$44.9	$16.4	$0.0	$133.4	$2.0	2 temporary bridge connections	**$196.7**
8A - No Water Quality Treatment	$45.4	$6.9	$0.0	$135.9	$0.0		**$188.2**
8B - Water Quality Treatment	$47.1	$17.2	$0.0	$140.3	$0.0		**$204.6**

NOTE: The installation and demolition costs for any wildlife features that would be installed in the corridor are not included.

21. Added Cost of Various Features

This section addresses the incremental cost of each of several corridor improvement or modification features. The cost for each is on the same basis as the complete total cost for any of the alternatives, namely including all multipliers and markups. The purpose of providing these costs is to facilitate the interpretation of the costs of each alternative, and to provide a gauge as to the contribution of total costs from selected features of the alternative. It is noted that the costs provided are approximate and could vary somewhat as that feature is applied at a specific location.

A. Box Culverts

For a 5 foot by 10 foot box culvert (inside dimensions), the installed cost including related excavation, headwalls, maintenance of traffic and road restoration, and other factors, is as follows:

Without Water Quality Treatment (60 feet long):	$ 1,376,625 each
With Water Quality Treatment (110 feet long):	$ 82,237 each

For the Without Water Quality Treatment option, the maintenance of traffic cost for each box culvert with a temporary detour to the south of the existing roadway is approximately $1.3 million. Another option may be to build the boxes in 1/3 segments, maintaining traffic within the existing roadway embankment; for this option the maintenance of traffic cost may be about $400,000 per culvert for a total cost of each at about $450,000. Yet another variation, would be to build the culverts in _ segments, which would require about 12 feet of encroachment into wetlands to the south to permit the construction installation and maintain two-way traffic flow; this option while not cost in detail might be expected to result in a cost per culvert of about $250,000 to $350,000 per culvert. A final option might be to jack a circular 5-foot diameter reinforced concrete pipe which could cost at least $80,000 per culvert; however, it would take 3 culverts to equal the hydraulic capacity of the rectangular box (thus the cost would be comparable to the rectangular box at the low end cost), and there is little cover and clearance below the pavement for this construction method.

B. Wildlife Shelves at Bridges

The installation of a wildlife shelf at the bridges provided for hydraulic flow is shown on the roadway bridge detail plate for each alternative. Basically, a 10-foot wide ledge with a ground elevation of 9.3 feet would be provided under the end span of each bridge. It is noted that as configured, the vertical clearance at this shelf would be only 4.2 feet from the low superstructure member elevation set for hydraulic clearance. To provide an 8-foot vertical clearance would require raising the bridge

and roadway approximately 3.8 feet. This has not been done for any of the structures as depicted herein, and would increase the amount of embankment, the project cost and incrementally the footprint of the roadway with some probable wetland impact. This facility would allow for passage of animals under the Tamiami Trail roadway.
The installed cost including related excavation, maintenance of traffic, and other factors, is as follows:

Wildlife Shelf at Bridges: $ 50,000 each

C. Wildlife Undercrossings

This facility would allow for passage of animals under the Tamiami Trail roadway. Plate WL-1 shows the key features of this bridge structure. . It is noted that as configured, the vertical clearance at this shelf would be only 4.2 feet from the low superstructure member elevation set for hydraulic clearance. To provide an 8-foot vertical clearance would require raising the bridge and roadway approximately 2.8 feet. This has not been done for any of the structures as depicted herein, and would increase the amount of embankment, the project cost and incrementally the footprint of the roadway with some probable wetland impact. The installed cost including related excavation, maintenance of traffic, and other factors, is as follows:

Wildlife Undercrossing at US 41: $ 2,030,026 each

Each undercrossing would require a 6-foot chain link fence extending _ mile in all four quadrants from the bridge for a total of 10,560 lineal feet of fencing, which is included in the above cited cost. If the fence can be integrated with the wildlife barrier in some instances, the additive cost of the fencing can be reduced.

D. Wildlife Canal Crossings

This facility would allow for passage of animals over the L-29 Canal. Plate WL-3 shows the key features of this bridge structure. The installed cost including related excavation, maintenance of traffic, and other factors, is as follows:

Wildlife Canal Crossing at L-29 Canal: $ 326,427 each

E. Wildlife Barriers

The proposed wildlife barrier is 4 feet in height with an overhang lip. Plate WL-2 depicts the placement of this element. As applied elsewhere, this element is essentially a short retaining wall. There are several issues associated with the placement of this feature within the typical section. These are discussed as follows:

Without Water Quality Treatment

With a narrower typical section and the existing embankment geotechnical features, placement of the wall is more difficult. One option is to integrate the wall with a concrete barrier feature for traffic safety, in lieu of the guardrail. Another option would be to place the wall with its base near the toe of the embankment slope. The preferred location for this feature would be near the edges of the typical section. At this location the wall will not pose a visual barrier and will not complicate slope maintenance. If placed in a retaining wall configuration, it could be used to reduce the width of the typical section slightly (this option is not depicted).

Within _ mile of any wildlife undercrossings, a fence with a 6-foot height is to be installed to channel large wildlife to the undercrossings. This could be accomplished by placement of a 2-3 foot fence on top of the wall for a cleaner installation and to save costs. However, if the wall was part of the concrete safety barrier for the roadway, the short fence could not be placed on top of the wall as it would be a "snagging hazard", and a different location would have to be selected.

With Water Quality Treatment

The preferred location for this feature would be near the edges of the typical section. At this location the wall will not pose a visual barrier and will not complicate slope maintenance. If placed in a retaining wall configuration, it could be used to reduce the width of the typical section slightly (this option is not depicted).

Within _ mile of any wildlife undercrossings, a fence with a 6-foot height is to be installed to channel large wildlife to the undercrossings. This could be accomplished by placement of a 2-3 foot fence on top of the wall for a cleaner installation with less cost.

Cost of Wildlife Barrier

While the precise cost varies with the typical section and placement of the wall, the approximate installed cost per foot of barrier is as follows:

Wildlife Barrier: $125 per lineal foot of barrier

F. Extension of Existing Pipe Culverts

For the extension of the existing box culverts, which are 5 feet inside diameter installed in triplets with common headwalls, the installed cost including related excavation, headwalls, maintenance of traffic and road restoration, and other factors, is as follows:

Pipe Culvert Extension (55 feet long): $ 7,700 each per culvert

22. Application of Wildlife Features to All Alternatives

To facilitate comparison of alternatives with regard to the application of various wildlife features, each of the alternatives was reviewed with respect to the potential inclusion of bridge shelves, wildlife undercrossings, and wildlife barrier features. On this basis, an estimated cost for better accommodating wildlife can be estimated for each alternative. The results of this analysis are summarized in Table 11.

Table 11
WILDLIFE FEATURE COST SUMMARY

Alternative	Shelf at Bridge	Wildlife Under-crossing	Wildlife Canal Crossing	Lineal Feet of Wildlife Barrier	Total Cost
	$50,000 each	$2,030,026 each	$326,427 each	$125 / L.F.	
Alternative 1 Existing Alignment with 4 New Bridges Without WQT	0	3	3	113,000	$21,194,359
Alternative 2A Existing Alignment and Raised Profile with 4 New Bridges Without WQT	4	2	2	110,000	$18,662,906
Alternative 2B Existing Alignment and Raised Profile with 4 New Bridges With WQT	4	2	2	110,000	$18,662,906
Alternative 3A North Alignment with 4 New Bridges Without WQT	4	2	2	110,000	$18,662,906
Alternative 3B North Alignment with 4 New Bridges Without WQT	4	2	2	110,000	$18,662,906
Alternative 4A South Alignment with 4 New Bridges Without WQT	4	2	2	110,000	$18,662,906
Alternative 4B South Alignment with 4 New Bridges With WQT	4	2	2	110,000	$18,662,906
Alternative 5A Raised Profile on Structure Without WQT	2	0	0	0	$100,000
Alternative 5B Raised Profile on Structure With WQT	2	0	0	0	$100,000
Alternative 6A Existing Alignment with 4-Mile Bridge Without WQT	2	2	2	70,800	$13,662,906
Alternative 6B Existing Alignment with 4-Mile Bridge With WQT	2	2	2	70,800	$13,662,906
Alternative 7A Existing Alignment with 3,000-Foot Bridge Without WQT	2	3	3	107,000	$20,544,359
Alternative 7B Existing Alignment with 3,000-Foot Bridge With WQT	2	3	3	107,000	$20,544,359

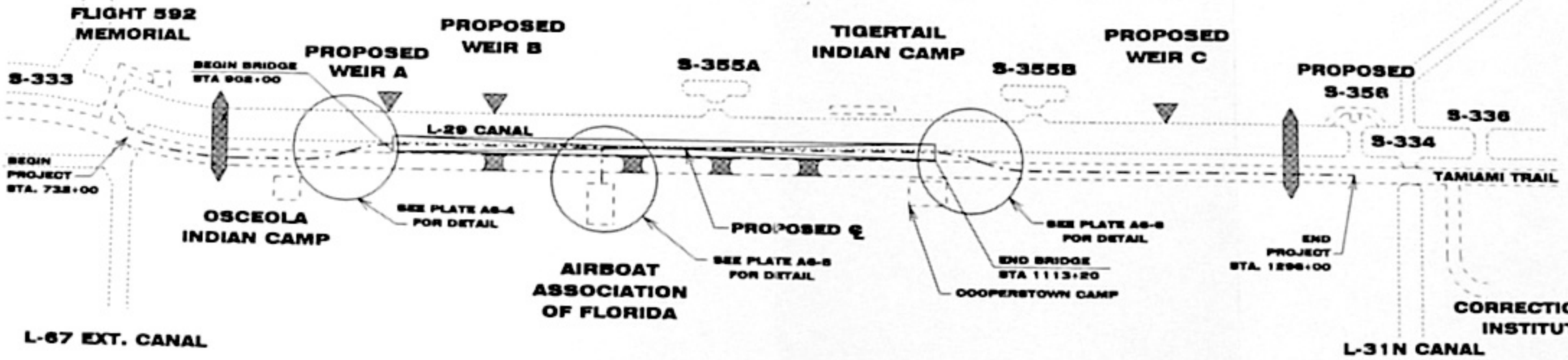
Alternative 8A Existing Alignment; 24 New + Existing Culverts Without WQT	0	3	3	113,000	$21,194,359
Alternative 8B Existing Alignment; 40 New Culverts With WQT	0	3	3	113,000	$21,194,359

With respect to the application of the roadway wildlife undercrossing in conjunction with the wildlife canal crossing in this corridor, a design issue was noted. Specifically, the finish elevation of a canal crossing is approximately 19 feet, while the elevation at an undercrossing is 6.5 feet for natural grade, and 9.3 feet at a bridge shelf location. Thus there is a 9.7 to 12.5 foot grade differential. This is complicated by the fact that the L-29 Canal and the existing US 41 roadway share a common embankment, and thus there is little space between the two to accommodate the grade difference. The available space is approximately 4 feet without water quality treatment and approximately 30 for the case with water quality treatment. The slopes would therefore range from 3.1:1to 0.3:1 – these are considered too steep. The slope should be no more than 4:1.

This can only be achieved by increasing the separation between the canal and the road, most likely by relocating the road a sufficient distance to the south, depending upon the alternative being considered. This increase will introduce horizontal curvatures into the road alignment, increase encroachment into the wetlands, and increase the cost. It is noted that the cost of this alignment adjustment is NOT included in any cost estimates within this document.

N

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



LEGEND

- PROPOSED BRIDGE
- PROPOSED BREACH IN EXISTING ROADWAY
- PROPOSED WILDLIFE CROSSING

EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR-MILE BRIDGE

DEPARTMENT OF THE ARMY
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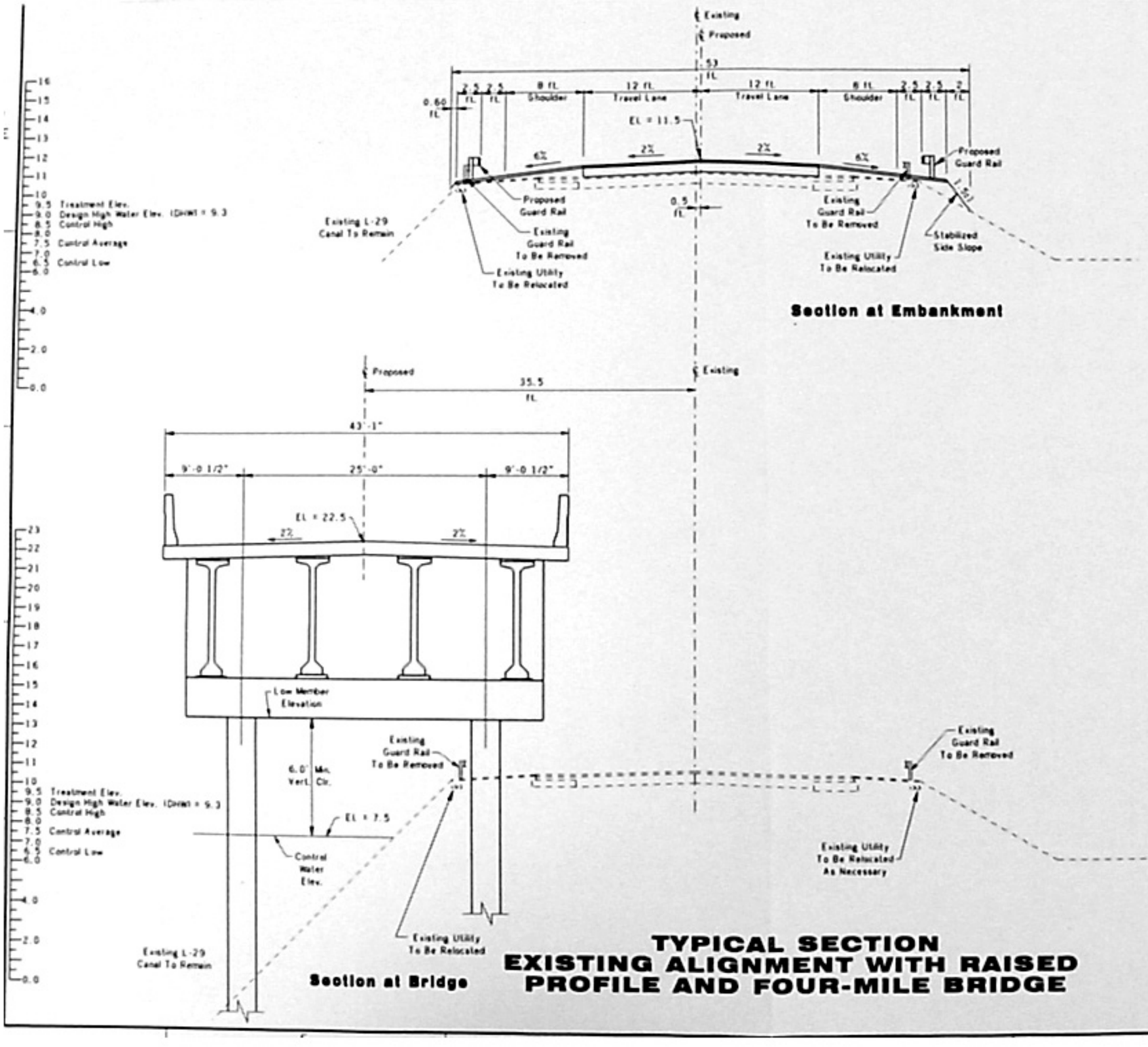
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

PLATE A6-1



Section at Embankment

Section at Bridge

TYPICAL SECTION EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR-MILE BRIDGE

Alternative 6A Without Water Quality Treatment

NOTE: REFER TO PLATE A8-2 FOR EMBANKMENT SECTION AT THE BOX CULVERT LOCATIONS

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

REVISIONS

NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

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CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

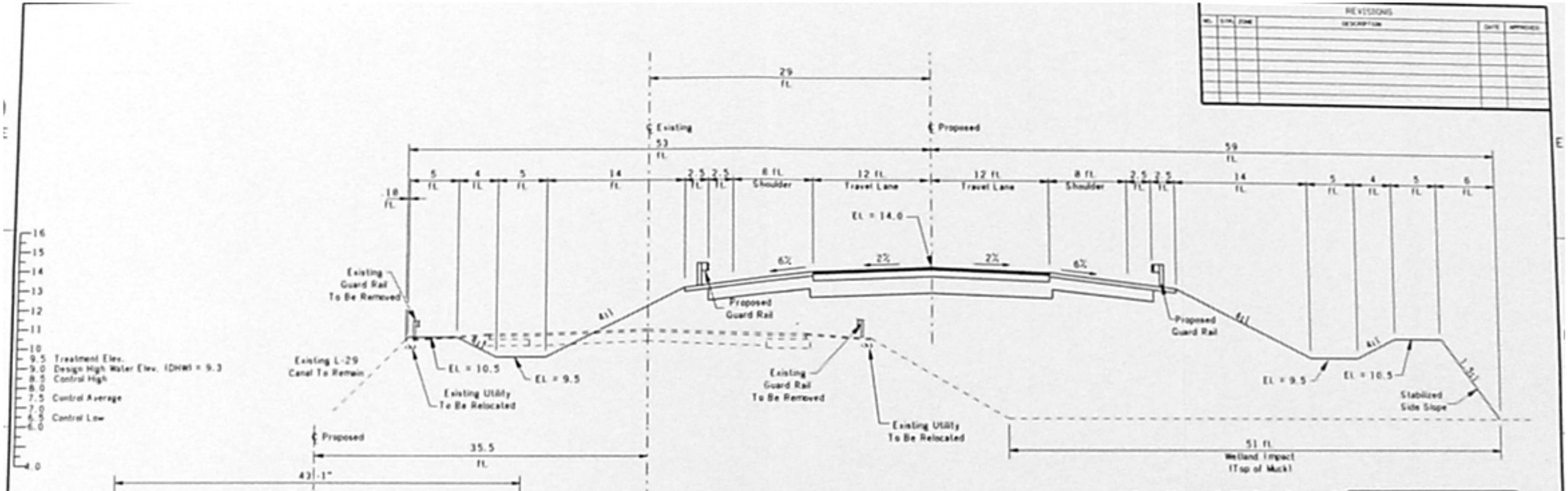
ALTERNATIVE 6

PLATE A6-2

D.O. FILE NO. 0005

REVISIONS

NO.	BY	ZONE	DESCRIPTION	DATE	APPROVED



Section at Embankment

Alternative 6B With Water Quality Treatment

Section at Bridge

NOTE: REFER TO PLATE A8-2 FOR EMBANKMENT SECTION AT THE BOX CULVERT LOCATIONS

TYPICAL SECTION EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR-MILE BRIDGE

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

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FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

PLATE A8-3

D.O.FILE NO. 0005

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

CANAL MAINTENANCE ROAD

BEGIN BRIDGE STA. 902+00

L-29 LEVEE

PROPOSED ℄

L-29 CANAL

PROPOSED BRIDGE

POT. Sta 890+50

890+00

895+00

900+00

905+00

910+00

915+00

LIMITS OF CONSTRUCTION

EVERGLADES SAFARI AIRBOATS (TO BE ABANDONED)

N O T E,
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION

EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR-MILE BRIDGE

DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

PLATE A6-4

O.D. FILE NO. 0005

CANAL MAINTENANCE ROAD

L-29 LEVEE

PROPOSED ℄

PROPOSED BRIDGE

L-29 CANAL

POT Sta 951+52.31

POT Sta 972+34.95

EQUATION: Sta 951+52.31 AH = Sta 951+52.30 BK

AIRBOAT ASSOCIATION OF FLORIDA

EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR-MILE BRIDGE

REVISIONS

NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

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CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

PLATE A6-5

O.D. FILE NO. 0005

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

CANAL MAINTENANCE ROAD

L-29 LEVEE

PROPOSED BRIDGE

PROPOSED ℄

L-29 CANAL

1100+00

1105+00

1110+00

1115+00

1120+00

1125+00

1130+00

POT Sta 1128+50.23

END BRIDGE
STA 1113+20

COOPERSTOWN

LIMITS OF CONSTRUCTION

EQUATION:
Sta 1128+50.23 AH
Sta 1128+50.21 BK

N O T E:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION

EXISTING ALIGNMENT WITH RAISED PROFILE AND FOUR-MILE BRIDGE

DEPARTMENT OF THE ARMY
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JACKSONVILLE, FLORIDA

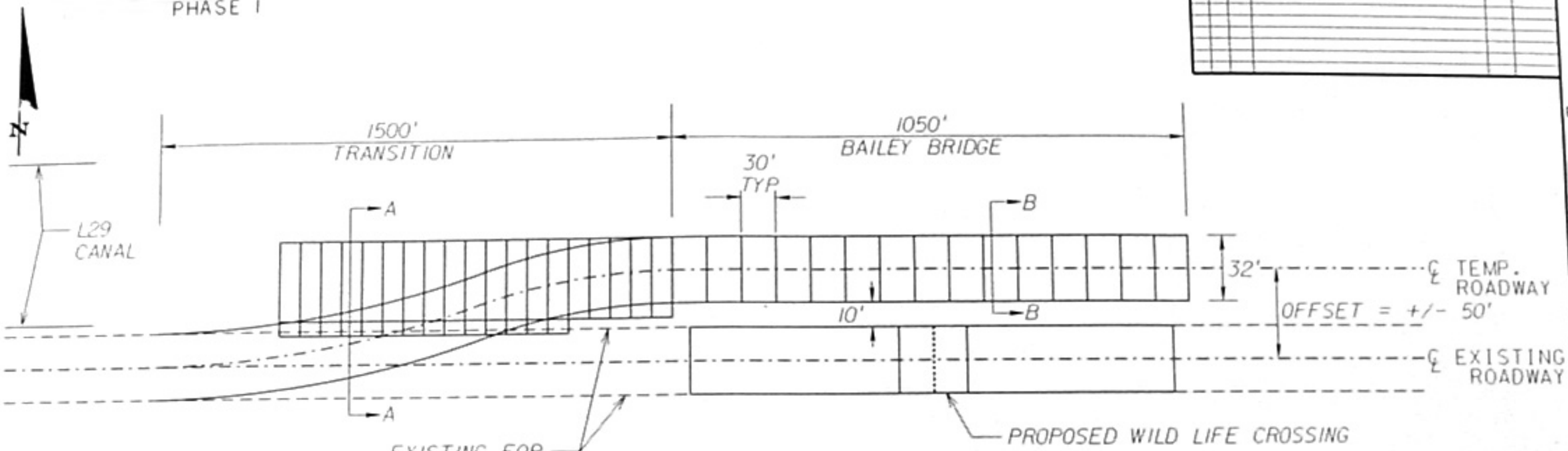
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

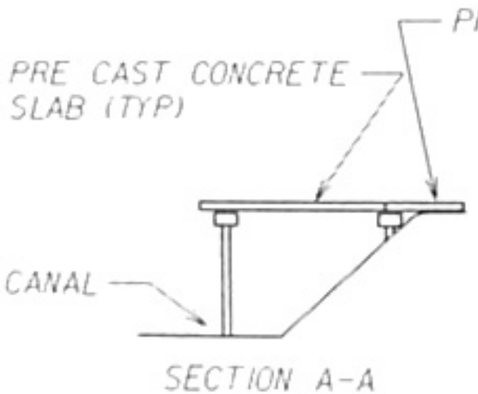
ALTERNATIVE 6

PLATE A6-6

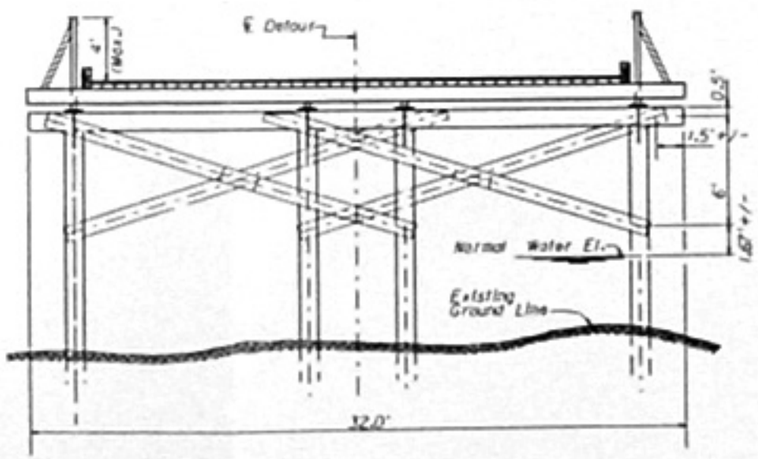
D.O.FILE NO. 0005

PHASE I





SECTION A-A



SCHEMATIC SECTION B-B

TEMPORARY ALIGNMENT NORTH OF EXISTING ROADWAY FOR WILDLIFE CROSSING CONSTRUCTION

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CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
CONSTRUCTION PHASES
ALTERNATIVE 6

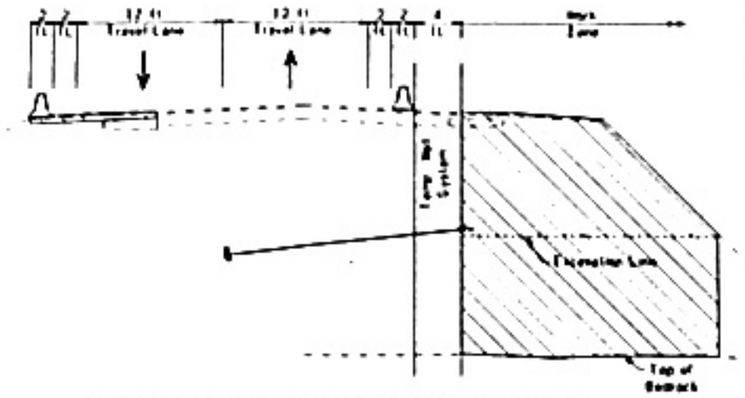
PLATE A6-7

PHASE 11A

1) Remove Existing Guardrail on north side
2) Place temporary pavement on north shoulder

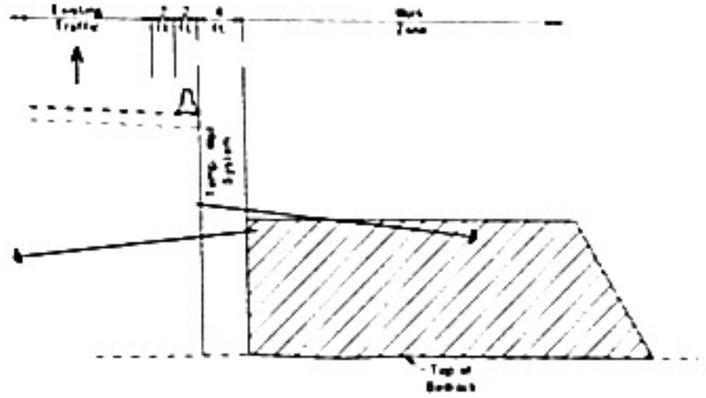
NOTES: Work in Phase 1 is to be done in 1/4 mile segments

PHASE 11B



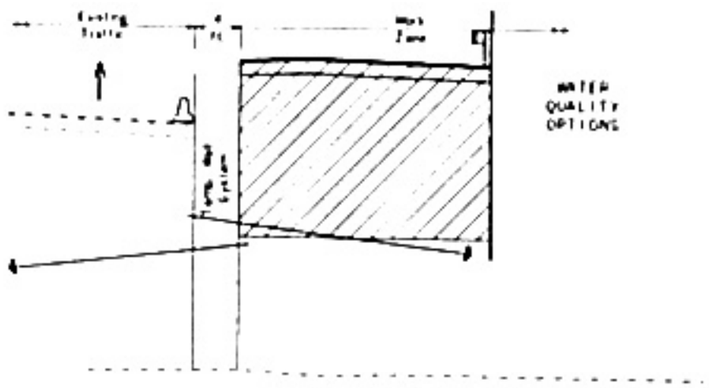
1) Place concrete barrier on north side of Westbound travel lane.
2) Shift existing traffic
3) Place concrete barrier on south side of Eastbound travel lane.
4) Begin installation of Temporary Wall System
5) Excavate on south side of Temporary Wall System to El. 7.0
6) Install tie-back anchorage system
7) Excavate retaining fill to top of Bedrock

PHASE 11C



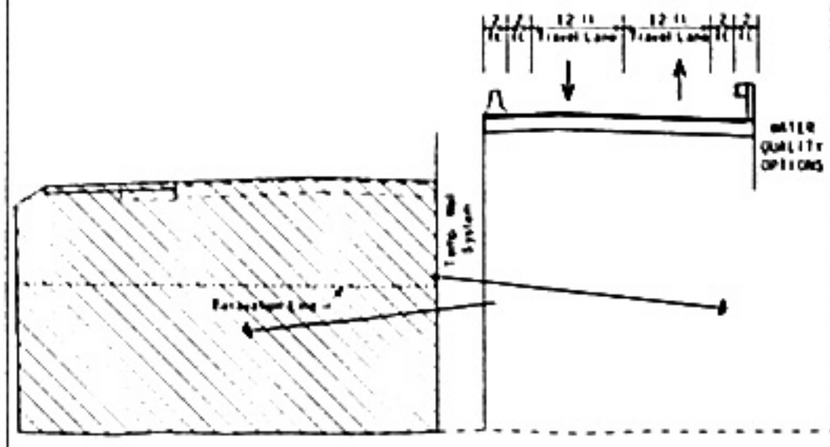
1) Fill Earthwork up to Elev. 7.0
2) Install tie back anchor on south side of Temporary Wall

PHASE 11D



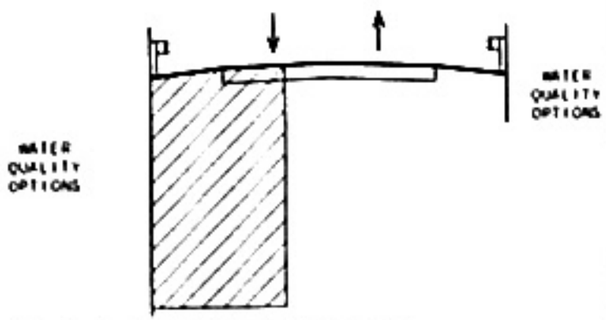
1) Complete construction of new Roadway on south side of Temporary Wall
2) Contractor shall not proceed to next Phase until all construction activities are complete to this point

PHASE 11E



1) Shift traffic on to new construction
2) Excavate on north side of temporary wall to El. 7.0
3) Install tie-back anchorage system for temporary wall
4) Excavate remaining fill to top of bedrock, cutting off soil anchor installed in Phase 11.

PHASE 11F



1) Fill Earthwork up to tie-back. Cut off anchorage
2) Complete construction on north side of temporary wall
3) Shift traffic to outside lanes of roadway
4) Complete overlay activities to finalize crown location
5) Shift traffic to ultimate location

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FOR FLOOD CONTROL AND OTHER PURPOSES
FAMIAMI TRAIL ALTERNATIVES

CONSTRUCTION PHASES ALTERNATIVE 6

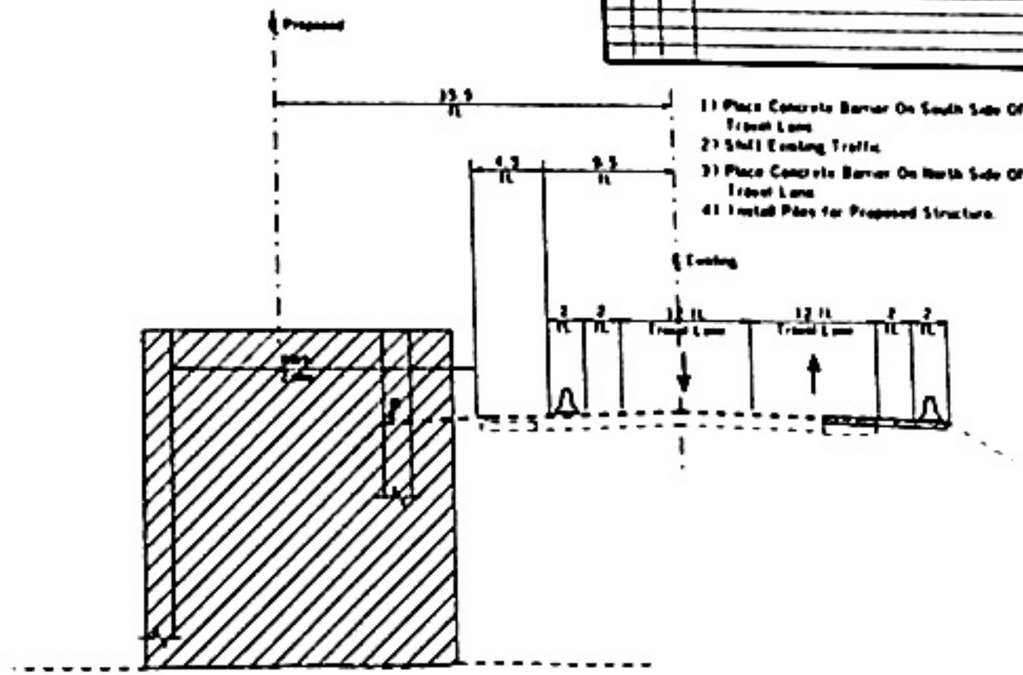
PLATE 46-B

PHASE I I I A

1) Remove Existing Guardrail on south side
2) Place temporary pavement on south shoulder.

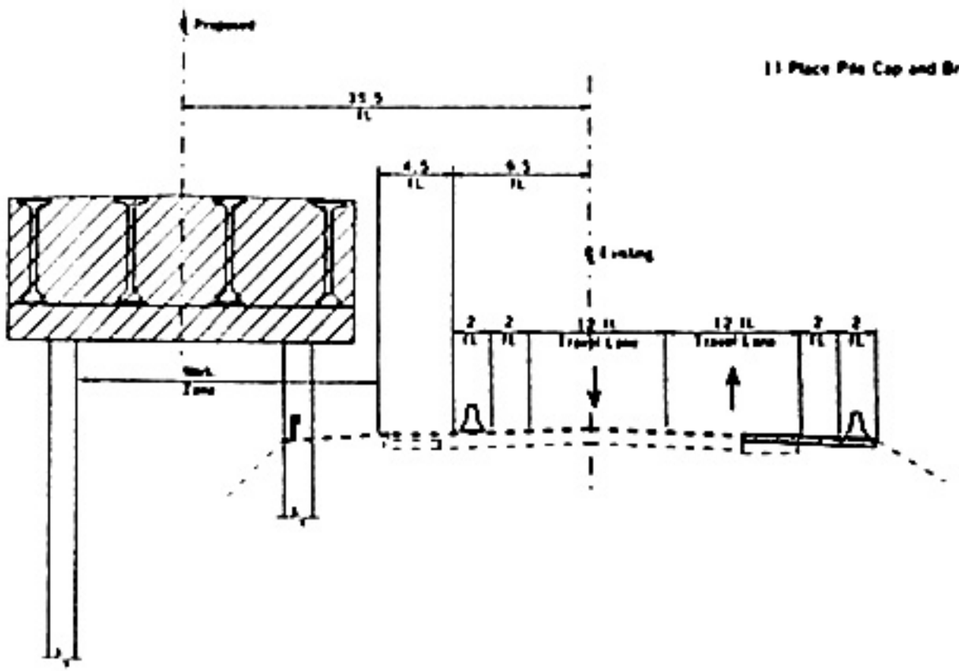
NOTE: Work on Phase I is to be done in 1/4 mile segments.

PHASE I I I B



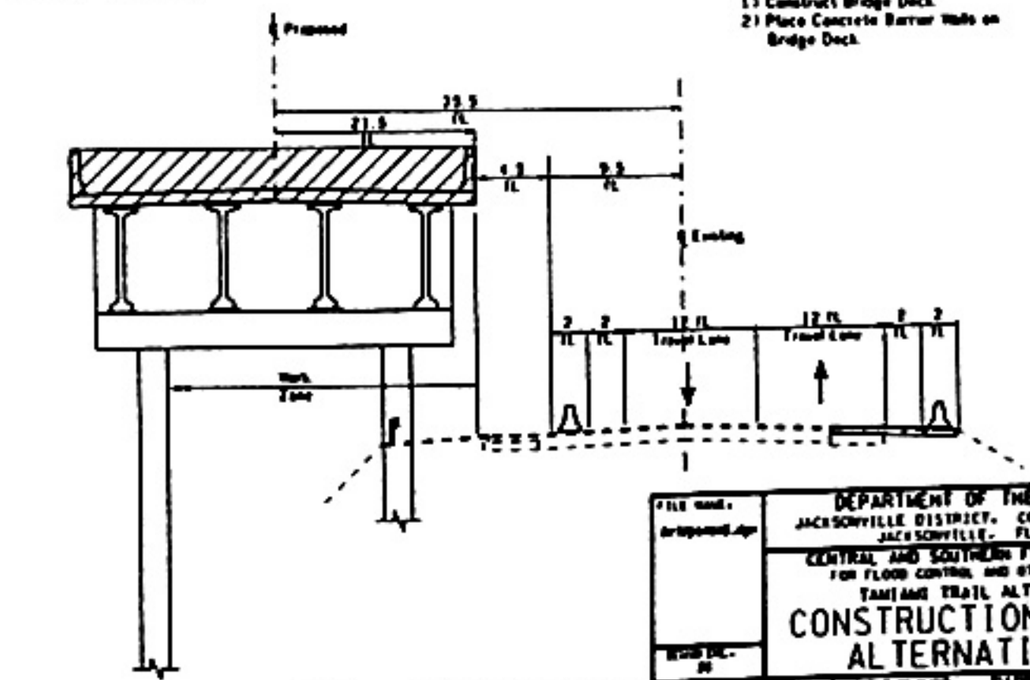
1) Place Concrete Barrier On South Side Of Eastbound Travel Lane
2) Shift Existing Traffic
3) Place Concrete Barrier On North Side Of Westbound Travel Lane
4) Install Piles for Proposed Structure.

PHASE I I I C



1) Place Pile Cap and Bridge Girders.

PHASE I I I D



1) Construct Bridge Deck.
2) Place Concrete Barrier Walls on Bridge Deck.

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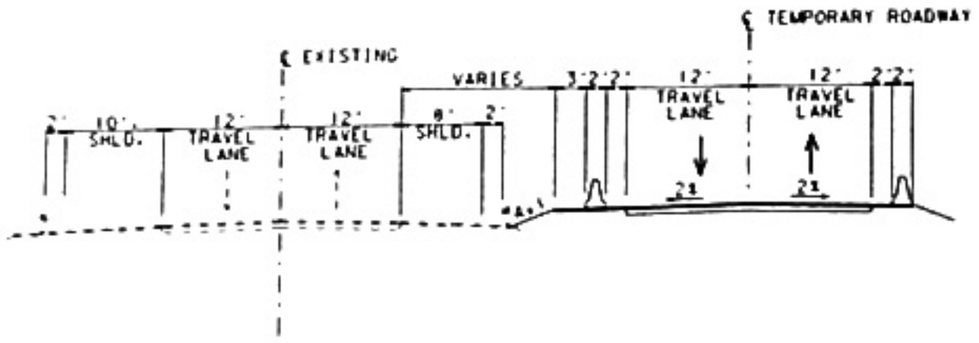
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

CONSTRUCTION PHASES ALTERNATIVE 6

PLATE A6-9

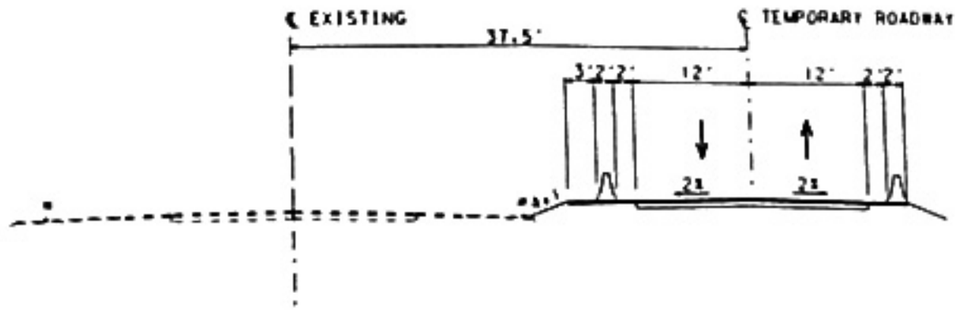
PHASE IVA

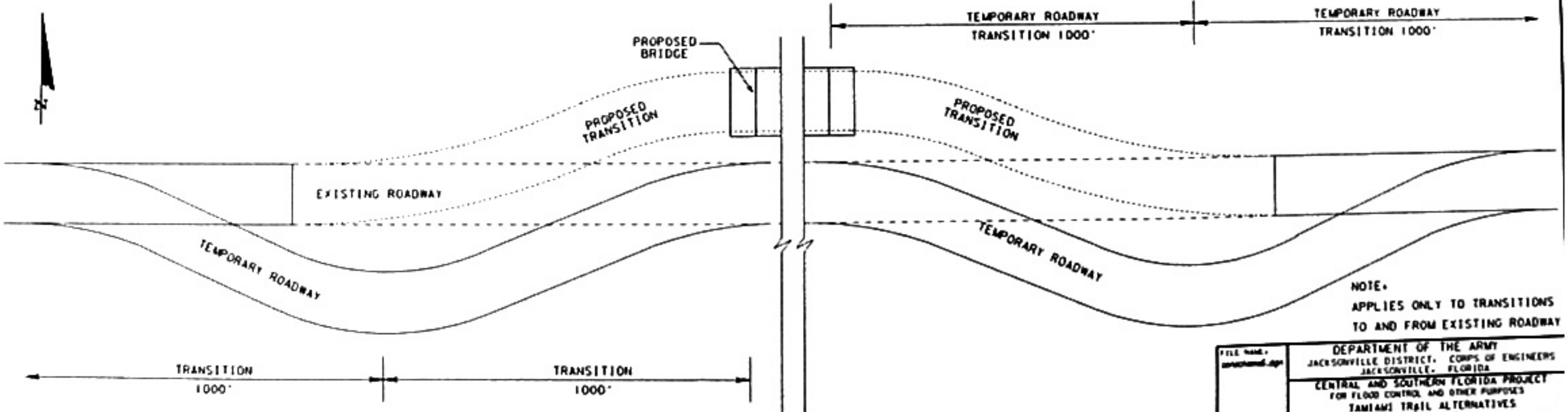
1) CONSTRUCT TEMPORARY ROADWAY.
2) SHIFT TRAFFIC ONTO TEMPORARY ROADWAY.



PHASE IVB

1) REMOVE EXISTING ROADWAY AS REQUIRED FOR CONSTRUCTION OF PROPOSED ALIGNMENT.
2) CONSTRUCT PROPOSED ROADWAY TRANSITION.
3) SHIFT TRAFFIC ONTO NEW ROADWAY.
4) REMOVE TEMPORARY ROADWAY.





TEMPORARY ROADWAY TRANSITIONS

NOTE:
APPLIES ONLY TO TRANSITIONS TO AND FROM EXISTING ROADWAY

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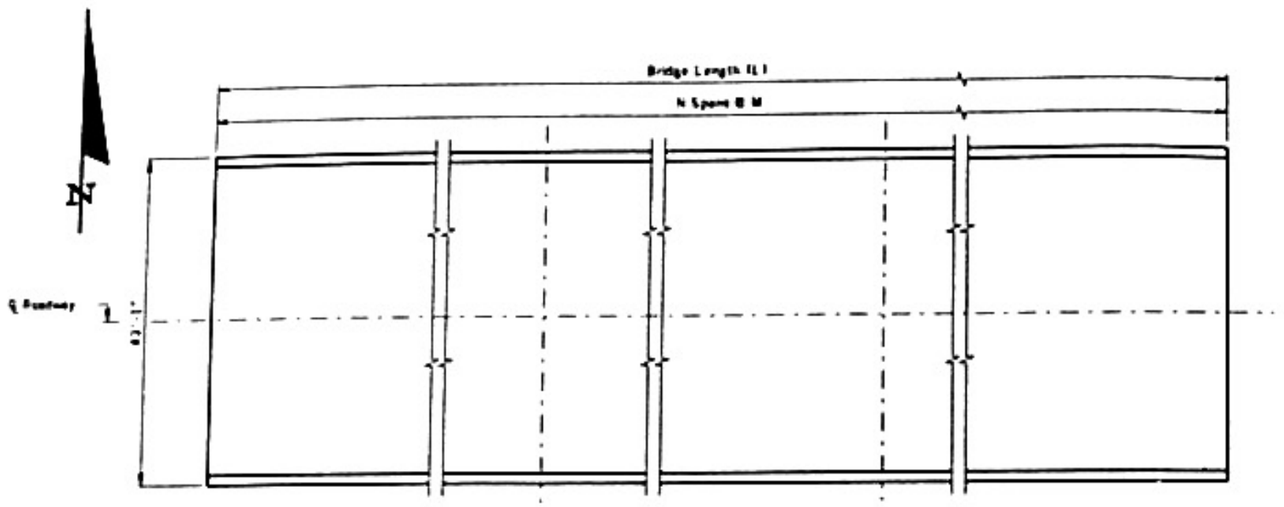
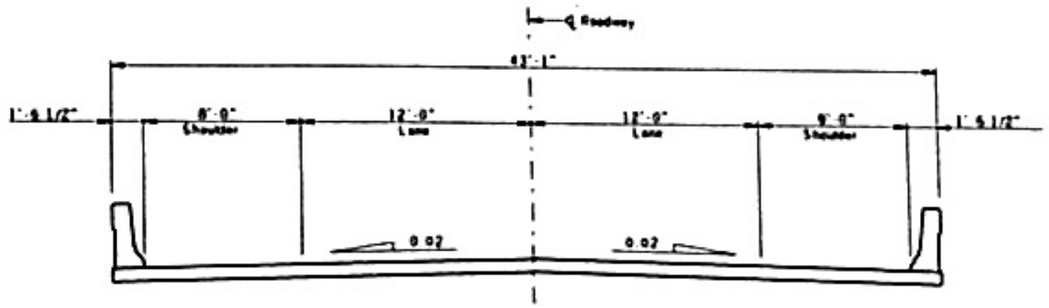
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

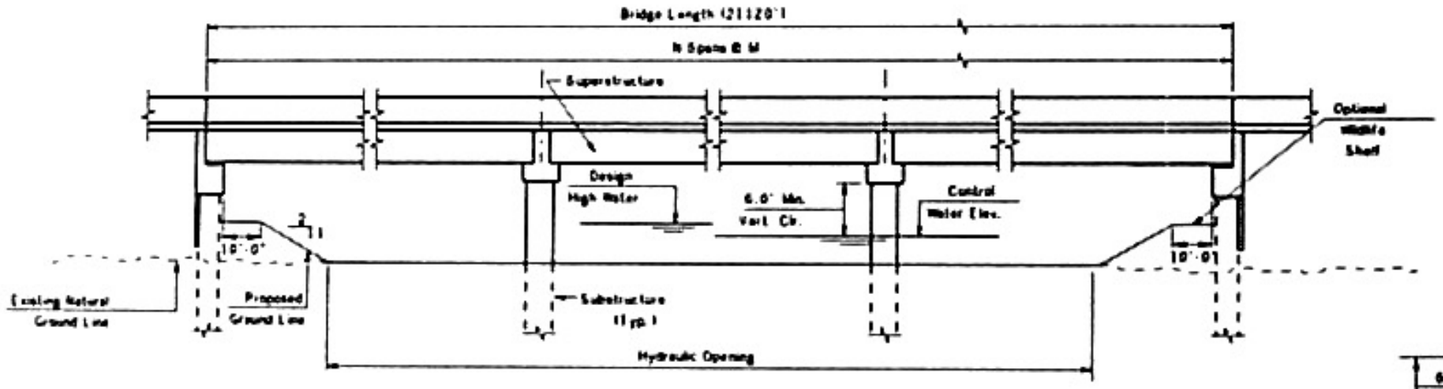
PLATE 46-10



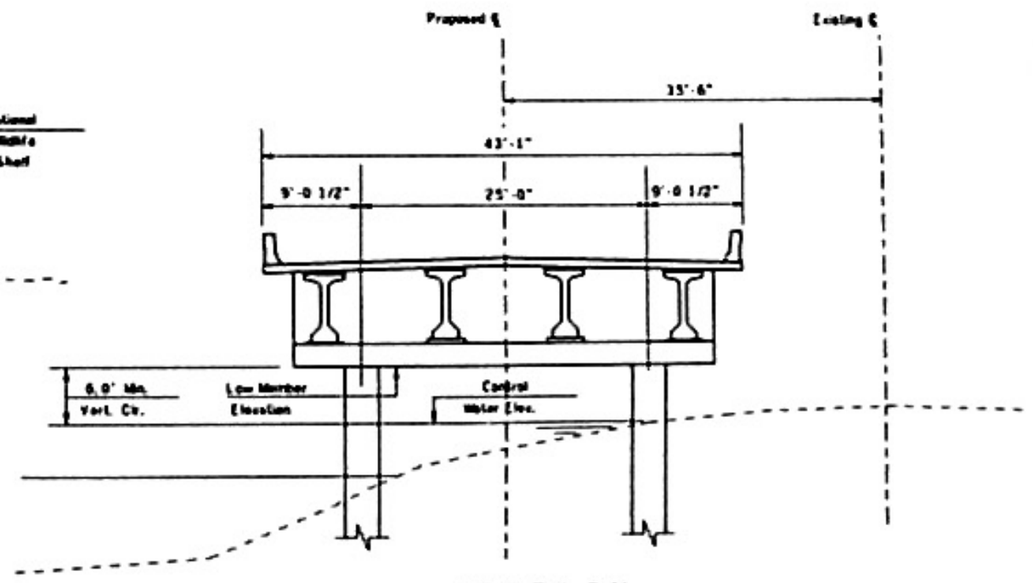
BRIDGE PLAN



BRIDGE TYPICAL SECTION



BRIDGE ELEVATION



SECTION
(LOOKING EAST)

Bridge Number	Bridge Type	Bridge Length (L)	Hydraulic Opening	Number of Spans (N)	Span Lengths (M)	Superstructure Type	Substructure Type	Design High Water	Control Water Elev.	Low Member Elevation
1	M	21120'	N/A	199	106.53'	AASHTO Type V	36" Drilled Shaft	9.3'	7.5'	13.5'

BRIDGE DATA

REVISIONS

NO.	BY	DATE	DESCRIPTION	CHKD	APPROVED

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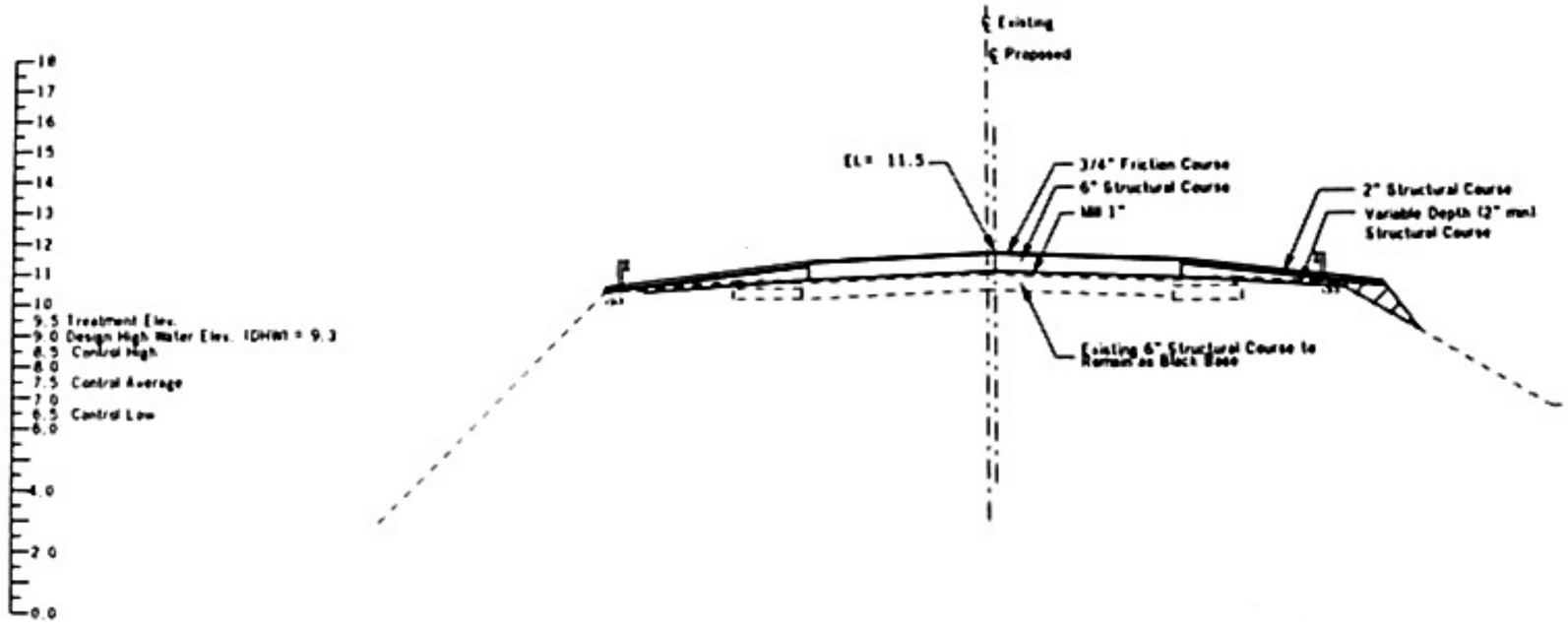
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

DRAWING NO. A6-11

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



LEGEND

= Select Fill (A-1, A-3)

TYPICAL SECTION
EMBANKMENT SECTION FOR ALTERNATIVE 6A

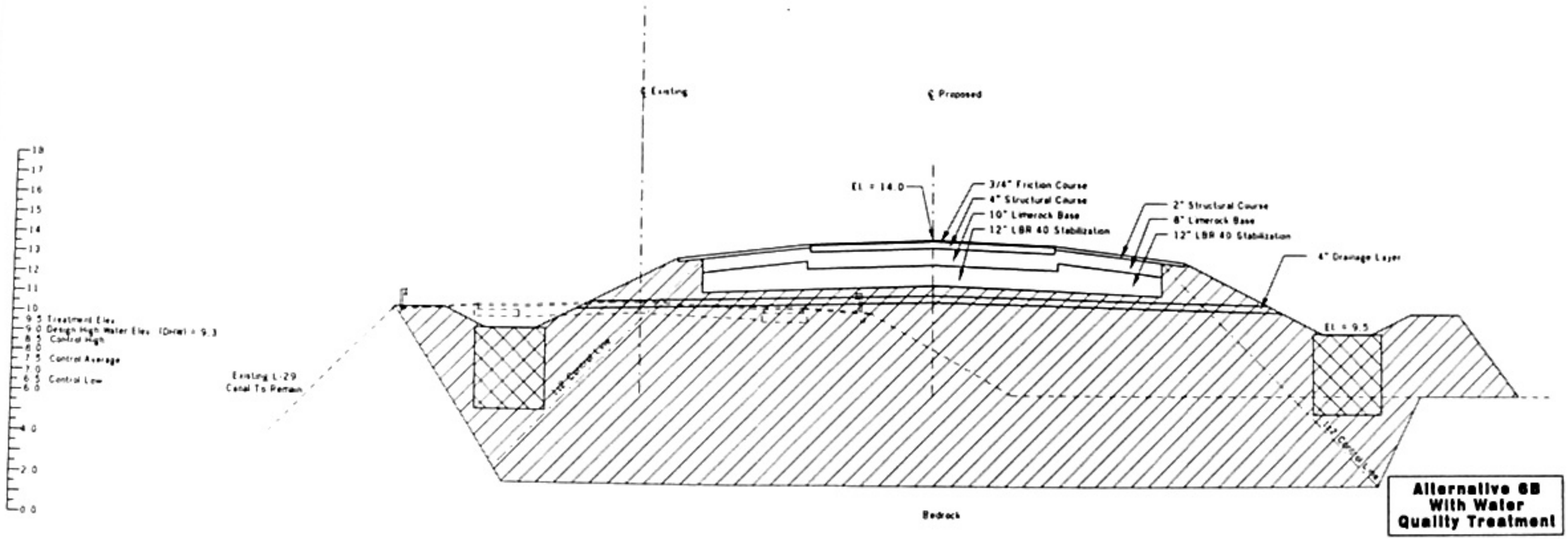
Alternative 6A Without Water Quality Treatment

LOOKING EAST

1" : 10' HORIZONTAL
1" : 5' VERTICAL

FILE name: dpw-a.dgn	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA
	CENTRAL AND SOUTHERN FLORIDA PROJECT FOR FLOOD CONTROL AND OTHER PURPOSES TAMIAMI TRAIL ALTERNATIVES
	ALTERNATIVE 6
DESIGNED: RF DRAWN: RF CHECKED: JH	Inv. NO. DACW17-80-D-0020 DATED: 4-DEC-2000 SCALE: AS SHOWN DATED:
	SIZE DRAWING NO. PLATE A6-12

REVISIONS					
NO.	BY	APP'D	DESCRIPTION	DATE	APPROVED



LEGEND

- = Select Fill (A-1, A-3)
- = Fine Aggregate (902-4)

TYPICAL SECTION
EMBANKMENT SECTION FOR ALTERNATIVE 6B

Alternative 6B With Water Quality Treatment

LOOKING EAST

1" : 10' HORIZONTAL
1" : 5' VERTICAL

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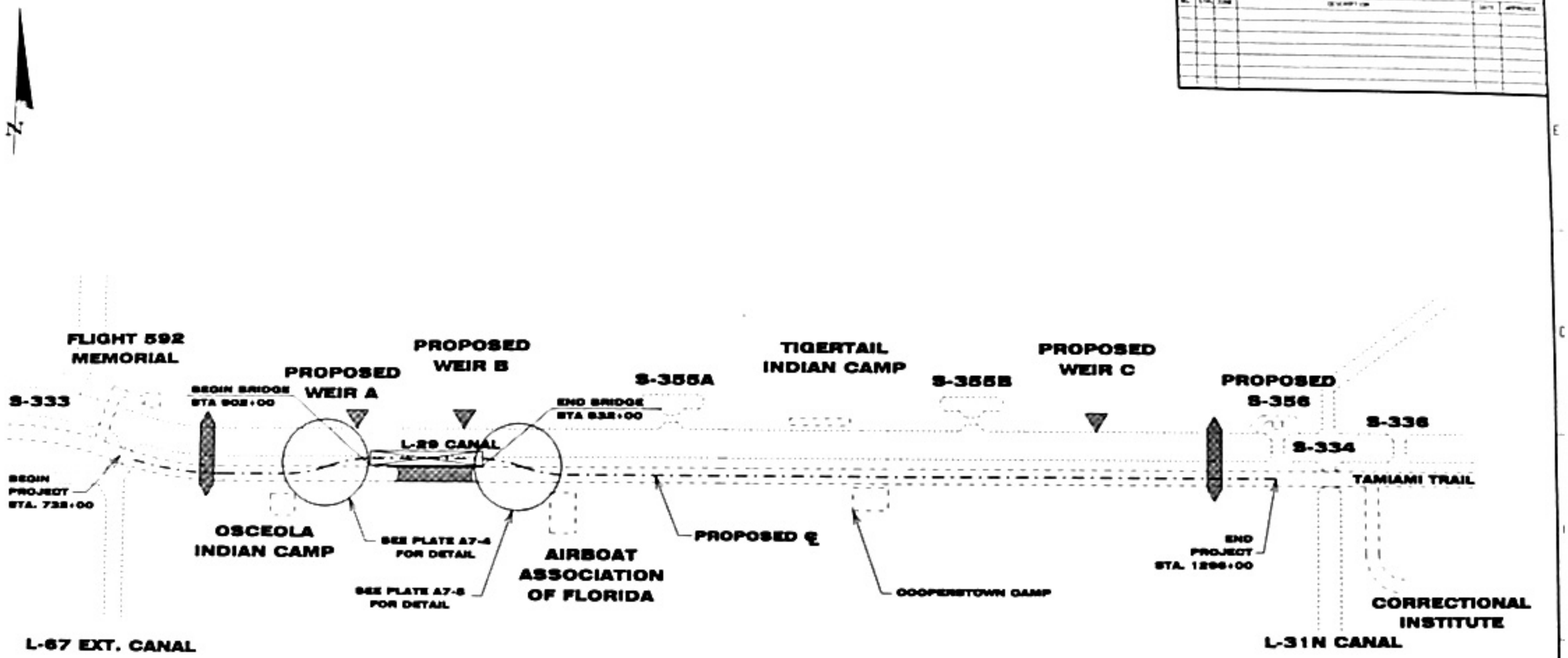
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 6

PLATE A6-13



EXISTING ALIGNMENT WITH RAISED PROFILE, 3000-FOOT BRIDGE, AND ADDITIONAL CULVERTS

LEGEND

- PROPOSED BRIDGE
- PROPOSED BREACH IN EXISTING ROADWAY
- PROPOSED WILDLIFE CROSSING

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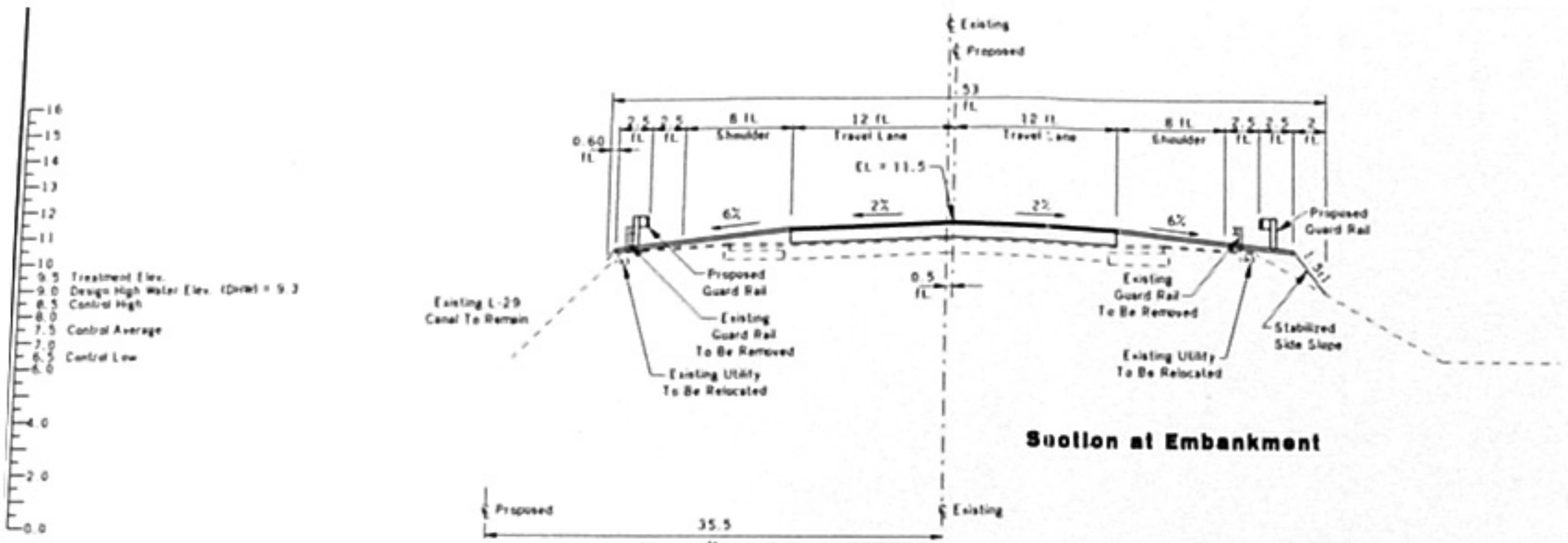
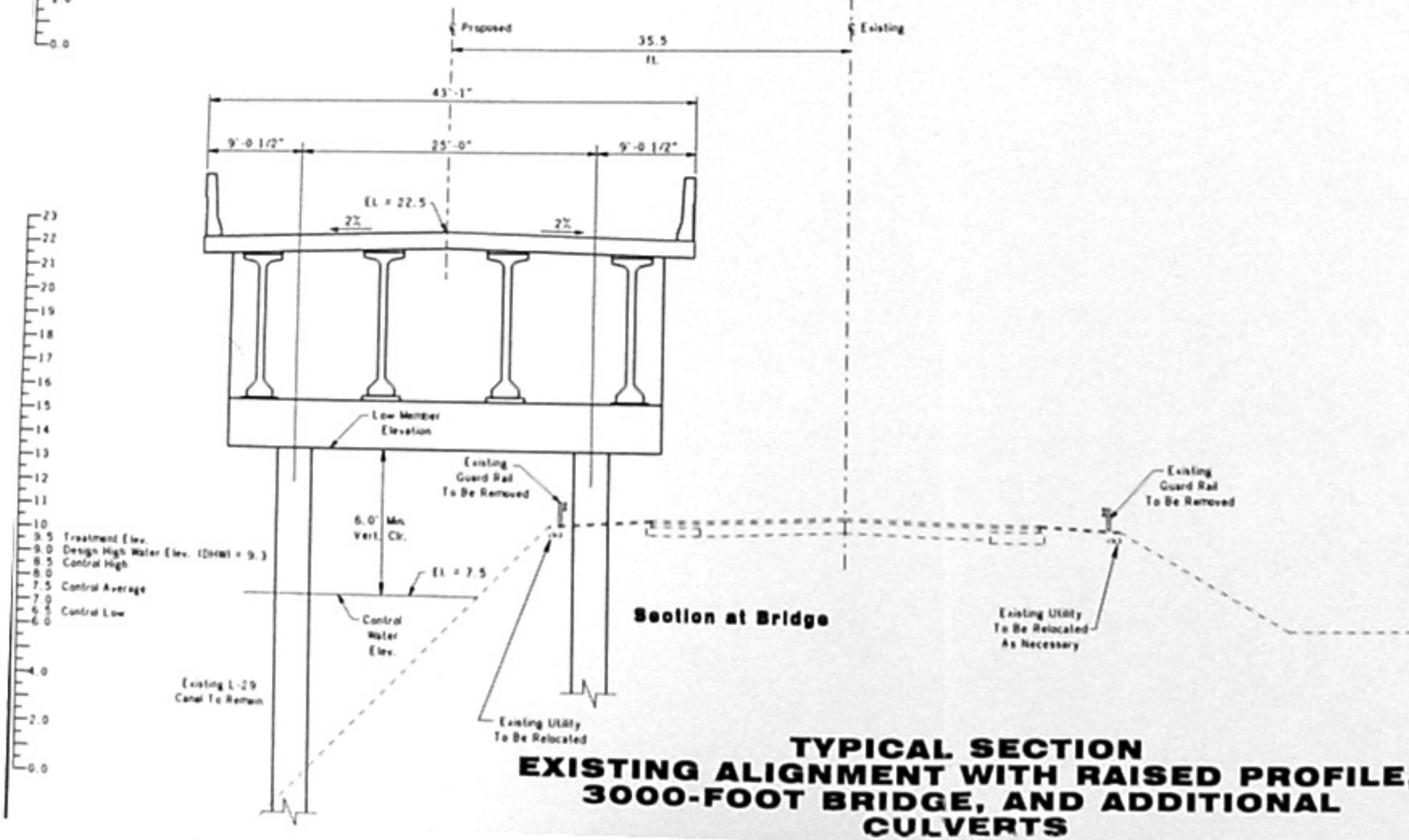
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

PLATE A7-1



Section at Embankment



Section at Bridge

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

TYPICAL SECTION EXISTING ALIGNMENT WITH RAISED PROFILE, 3000-FOOT BRIDGE, AND ADDITIONAL CULVERTS

Alternative 7A Without Water Quality Treatment

REVISIONS

NO.	BY	ZONE	DESCRIPTION	DATE	APPROVED

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CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

PLATE A7-2

NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED
			REVISIONS		

Existing
29 FL
Proposed
53 FL
59 FL

5 FL | 4 FL | 5 FL | 14 FL | 2.5 FL | 2.5 FL | 8 FL Shoulder | 12 FL Travel Lane | 12 FL Travel Lane | 8 FL Shoulder | 2.5 FL | 2.5 FL | 14 FL | 5 FL | 4 FL | 5 FL | 6 FL

18 FL

EL = 14.0

6% 2% 2% 6%

Existing Guard Rail To Be Removed

Proposed Guard Rail

Proposed Guard Rail

4:1

3:1

5

Existing L-29 Canal To Remain

EL = 10.5

EL = 9.5

Existing Utility To Be Relocated

Existing Guard Rail To Be Removed

Existing Utility To Be Relocated

EL = 9.5

EL = 10.5

Stabilized Side Slope

51 FL
Wetland Impact
(Top of Muck)

16
15
14
13
12
11
10
9.5 Treatment Elev.
9.0 Design High Water Elev. (DHW) = 9.3
8.5 Control High
8.0
7.5 Control Average
7.0
6.5 Control Low
6.0
1.0
2.0
0.0

Section at Embankment

Alternative 7B With Water Quality Treatment

Proposed
35.5 FL
Existing

43'-1"
9'-0 1/2" | 25'-0" | 9'-0 1/2"

EL = 22.5

2% 2%

Down Spout

Down Spout

8" Drain Pipe

Low Member Elevation

Existing Guard Rail To Be Removed

6.0' Min. Vert. Clr.

EL = 7.5

Control Water Elev.

Existing L-29 Canal To Remain

Existing Utility To Be Relocated

-23
-22
-21
-20
-19
-18
-17
-16
-15
-14
-13
-12
-11
-10
9.5 Treatment Elev.
9.0 Design High Water Elev. (DHW) = 9.3
8.5 Control High
8.0
7.5 Control Average
7.0
6.5 Control Low
6.0
-4.0
-2.0
-0.0

10 FL

4:1

2:1

1.5:1

15 FL

Existing Guard Rail To Be Removed

Existing Utility To Be Relocated As Necessary

Section at Bridge

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

FILE NAME: typsec7.dgn

DESIGN ENG.: SS

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CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

DRAWING NO.: PLATE A7-3

TYPICAL SECTION EXISTING ALIGNMENT WITH RAISED PROFILE, 3000-FOOT BRIDGE, AND ADDITIONAL CULVERTS

REVISIONS					
NO.	ETAL	ZONE	DESCRIPTION	DATE	APPROVED

CANAL MAINTENANCE ROAD

BEGIN BRIDGE STA. 902+00

L-29 LEVEE

L-29 CANAL

PROPOSED ℄

PROPOSED BRIDGE

POT Sta 895+00

895+00

900+00

905+00

LIMITS OF CONSTRUCTION

EVERGLADES SAFARI AIRBOATS
(TO BE ABANDONED)

NOTE:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

PLATE A7-4

EXISTING ALIGNMENT WITH RAISED PROFILE, 3000-FOOT BRIDGE AND ADDITIONAL CULVRETS

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

CANAL MAINTENANCE ROAD

L-29 LEVEE

PROPOSED ℄

L-29 CANAL

POT Sta 927+23.63

POT Sta 951+52.31

930+00

935+00

940+00

945+00

950+00

955+00

END BRIDGE
STA. 932+00

PROPOSED BRIDGE

LIMITS OF CONSTRUCTION

EQUATION:
Sta 951+52.31 AH
Sta 951+52.30 BK

EXISTING ALIGNMENT WITH RAISED PROFILE, 3000-FOOT BRIDGE AND ADDITIONAL CULVERTS

N O T E:
LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION

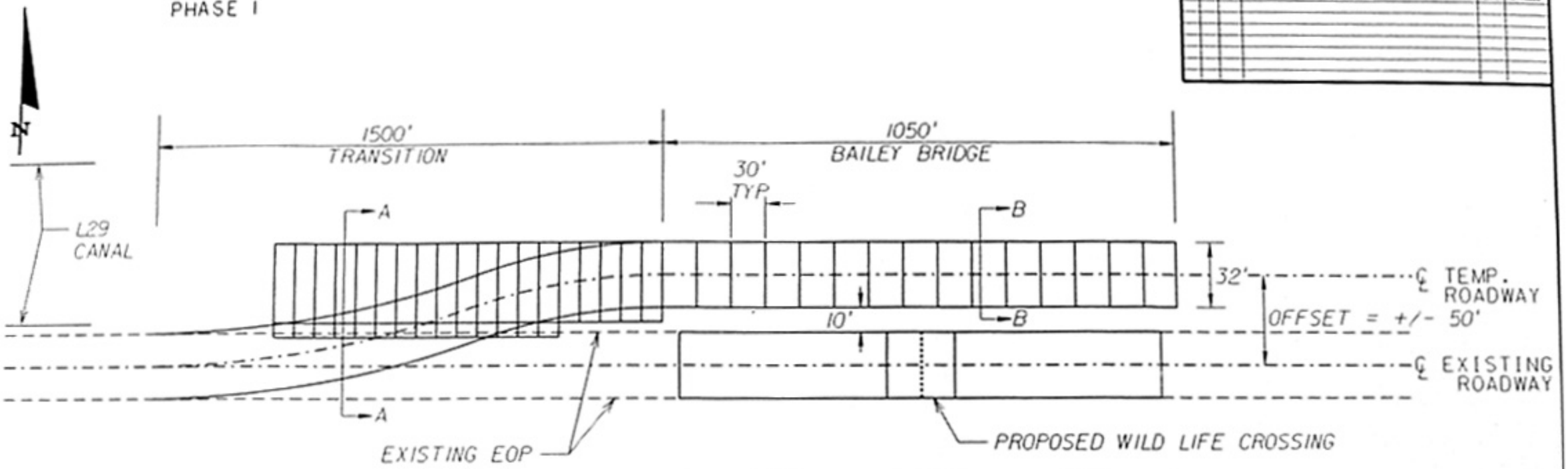
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

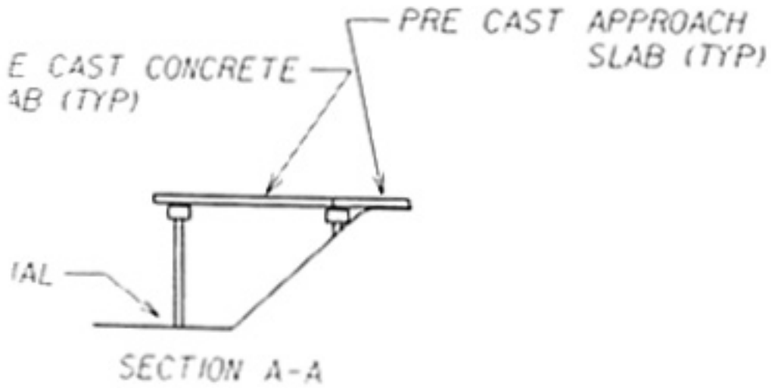
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

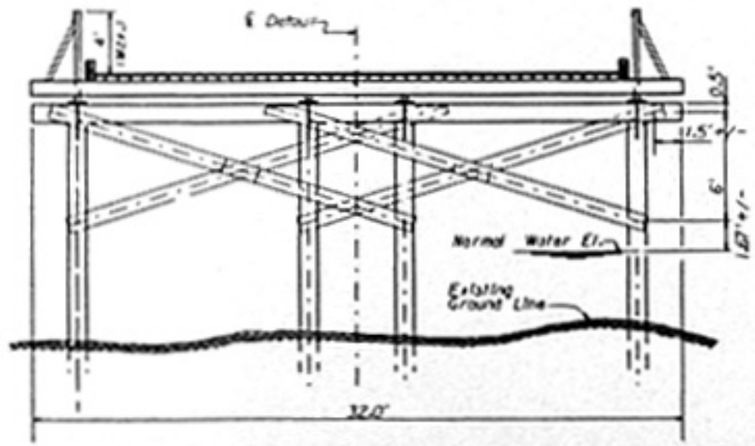
PLATE A7-5

PHASE I





SECTION A-A



SCHEMATIC SECTION B-B

TEMPORARY ALIGNMENT NORTH OF EXISTING ROADWAY FOR WILDLIFE CROSSING CONSTRUCTION

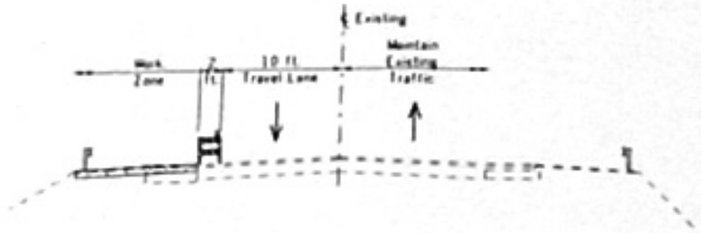
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

CONSTRUCTION PHASES
ALTERNATIVE 7

PLATE AT-6

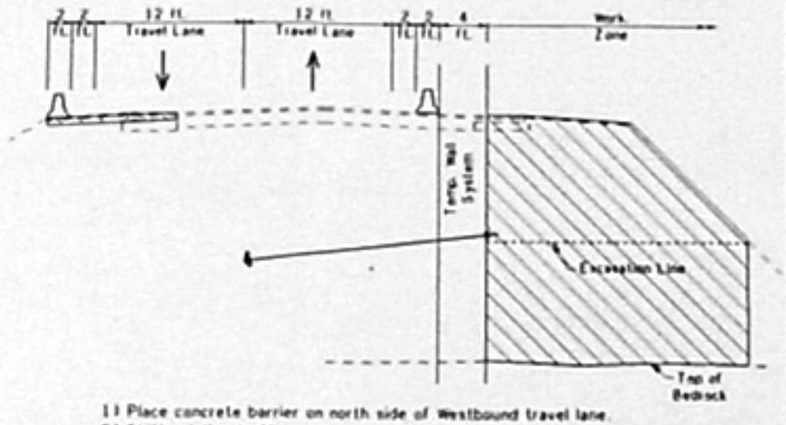
PHASE I I A



1) Remove Existing Guardrail on north side.
2) Place temporary pavement on north shoulder.

NOTE: Work in Phase I is to be done in 1/4 mile segments.

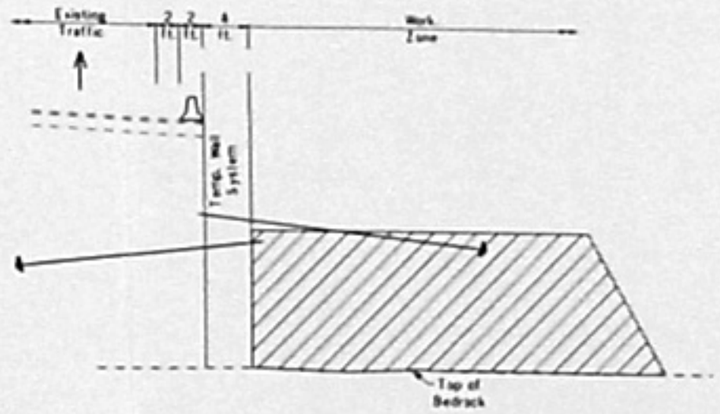
PHASE I I B



1) Place concrete barrier on north side of Westbound travel lane.
2) Shift existing traffic
3) Place concrete barrier on south side of Eastbound travel lane.
4) Begin installation of Temporary Wall System.
5) Excavate on south side of Temporary Wall System to El. 7.0.
6) Install tie-back anchorage system.
7) Excavate retaining fill to top of Bedrock.

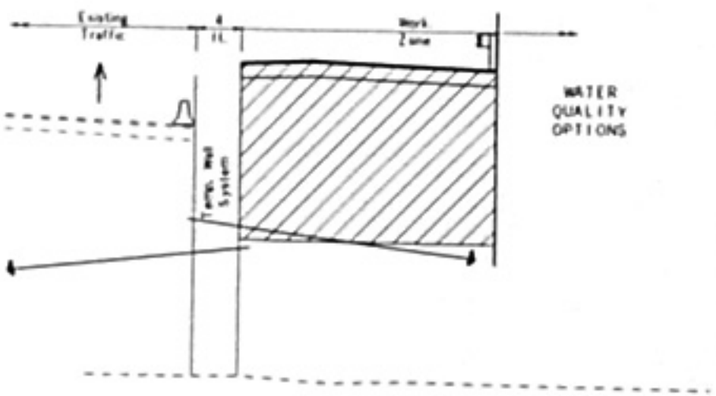
PHASE I I C

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



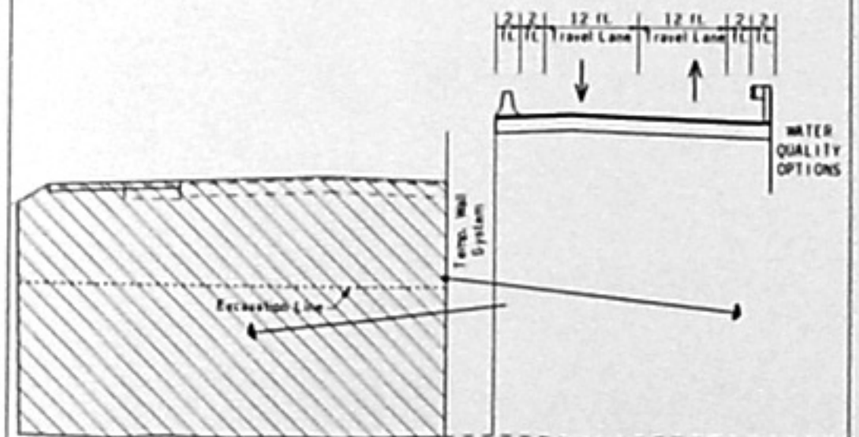
1) Fill Earthwork up to Elev. 7.0.
2) Install tie-back anchor on south side of Temporary Wall.

PHASE I I D



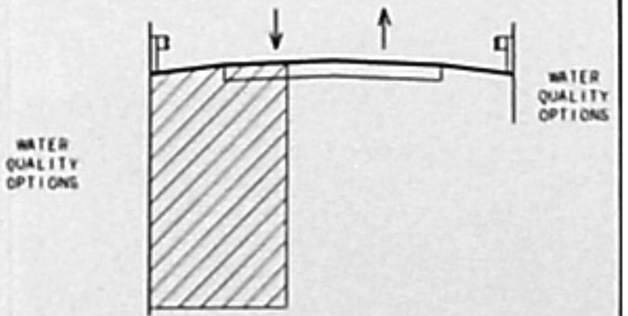
1) Complete construction of new Roadway on south side of Temporary Wall.
2) Contractor shall not proceed to next Phase until all construction activities are complete to this point.

PHASE I I E



1) Shift traffic on to new construction
2) Excavate on north side of temporary wall to El. 7.0.
3) Install tie-back anchorage system for temporary wall.
4) Excavate remaining fill to top of bedrock, cutting off soil anchor installed in Phase I I.

PHASE I I F



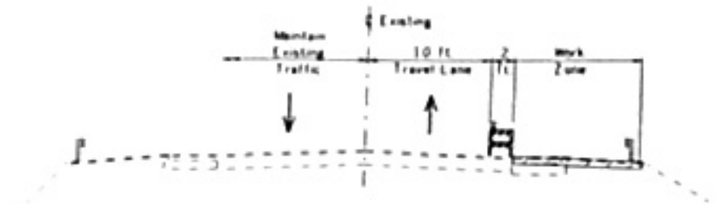
1) Fill Earthwork up to tie-back. Cut off anchorage.
2) Complete construction on north side of temporary wall.
3) Shift traffic to outside lanes of roadway.
4) Complete overlay activities to finalize crown location.
5) Shift traffic to ultimate location.

FILE NAME: mult.dgn
DESIGN ENG.: SD
DRN. BY: JR
CHD. BY: DH

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
CONSTRUCTION PHASES
ALTERNATIVE 7

INV. NO.: DACW17-79-D-0035
DATED: 17 MAY 1979
DRAWING NO.: PLATE A7-7
SCALE: NTS
DATED:

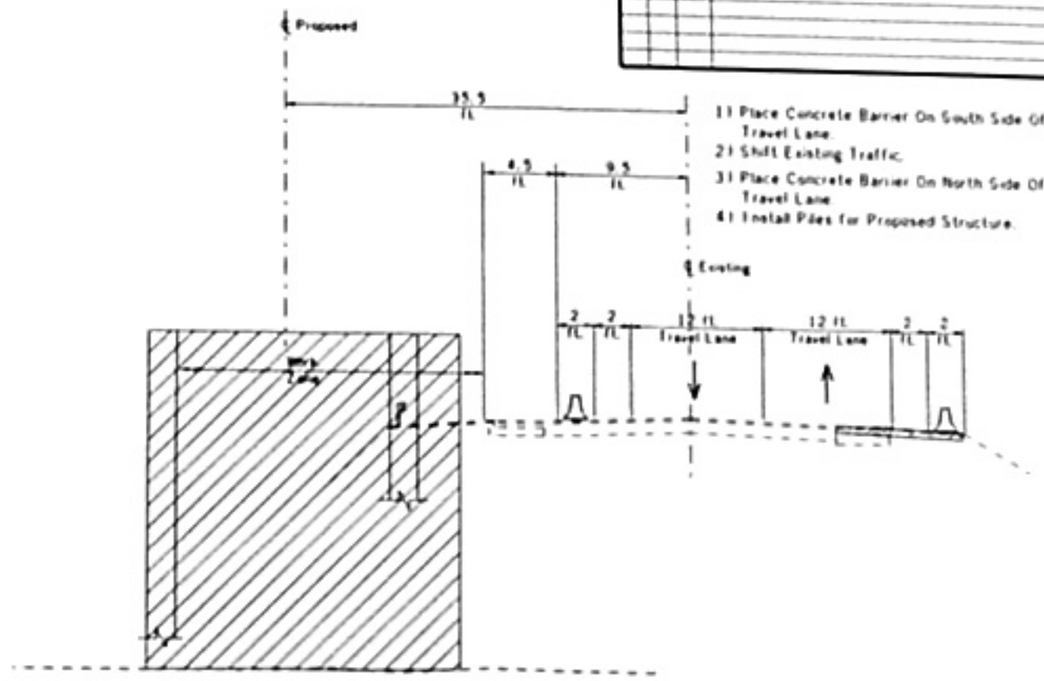
PHASE I I I A



1) Remove Existing Guardrail on south side
2) Place temporary pavement on south shoulder.

NOTE: Work in Phase I is to be done in 1/4 mile segments.

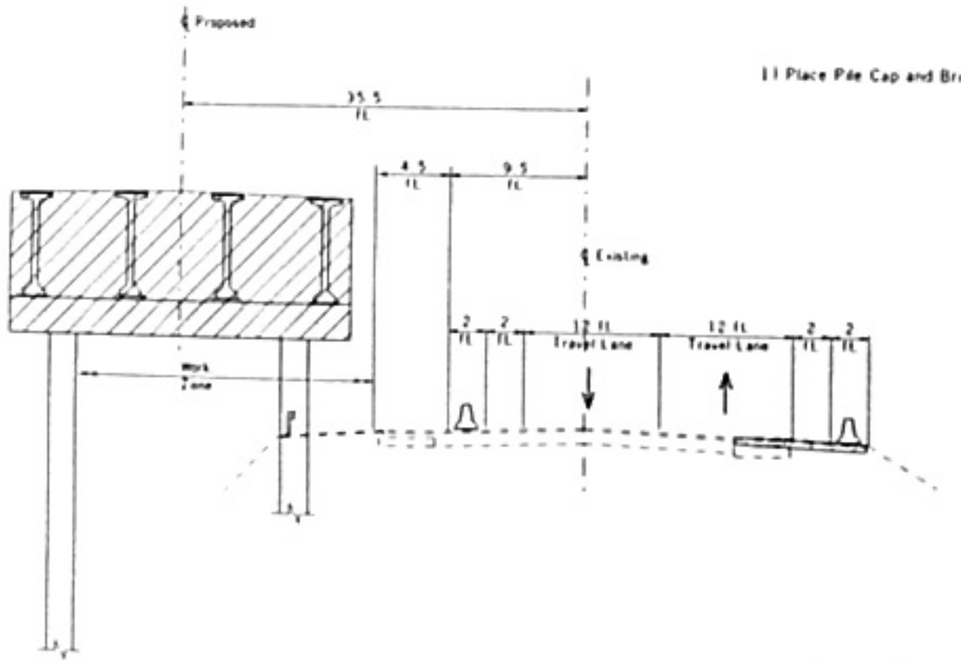
PHASE I I I B



1) Place Concrete Barrier On South Side Of Eastbound Travel Lane.
2) Shift Existing Traffic.
3) Place Concrete Barrier On North Side Of Westbound Travel Lane.
4) Install Piles for Proposed Structure.

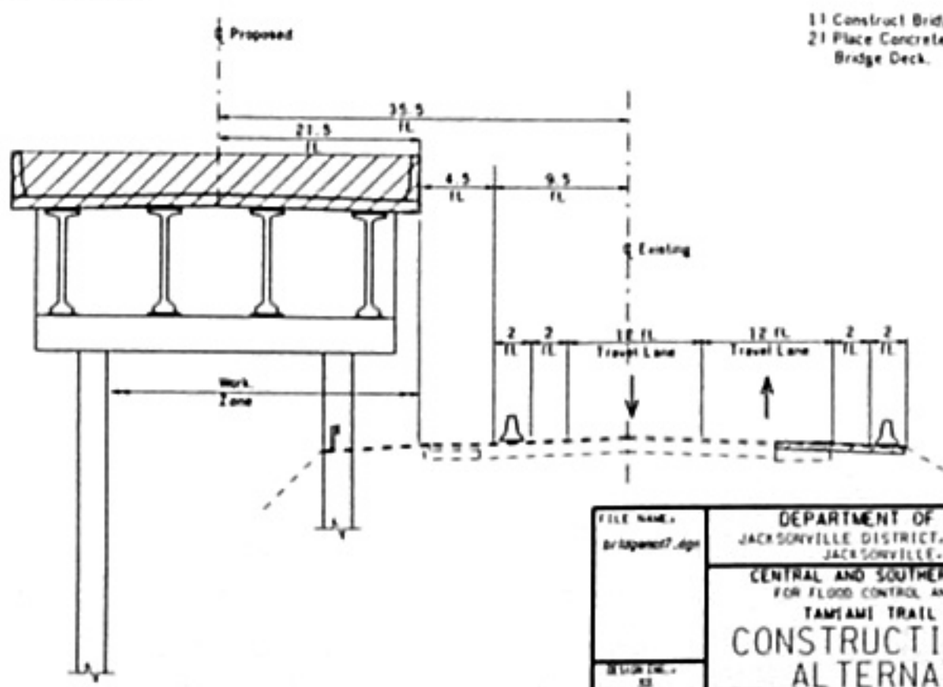
REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

PHASE I I I C



1) Place Pile Cap and Bridge Girders.

PHASE I I I D



1) Construct Bridge Deck.
2) Place Concrete Barrier Walls on Bridge Deck.

FILE NAME: bridgeset7.dgn

DESIGNED: RB

DRAWN: JB

CHECKED: DH

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

CONSTRUCTION PHASES ALTERNATIVE 7

ENV. NO.

DATED:

SIZE: D

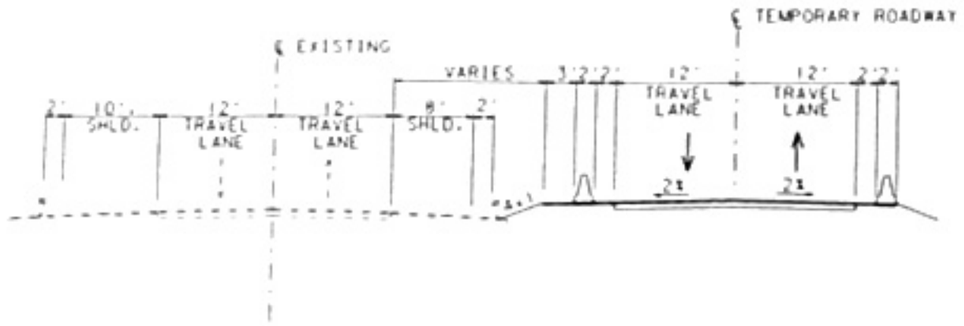
DRAWING NO.: PLATE A7-8

SCALE: AS

DATED:

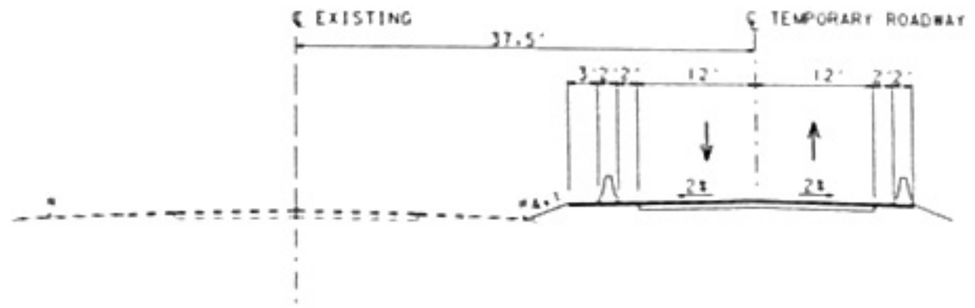
PHASE IVA

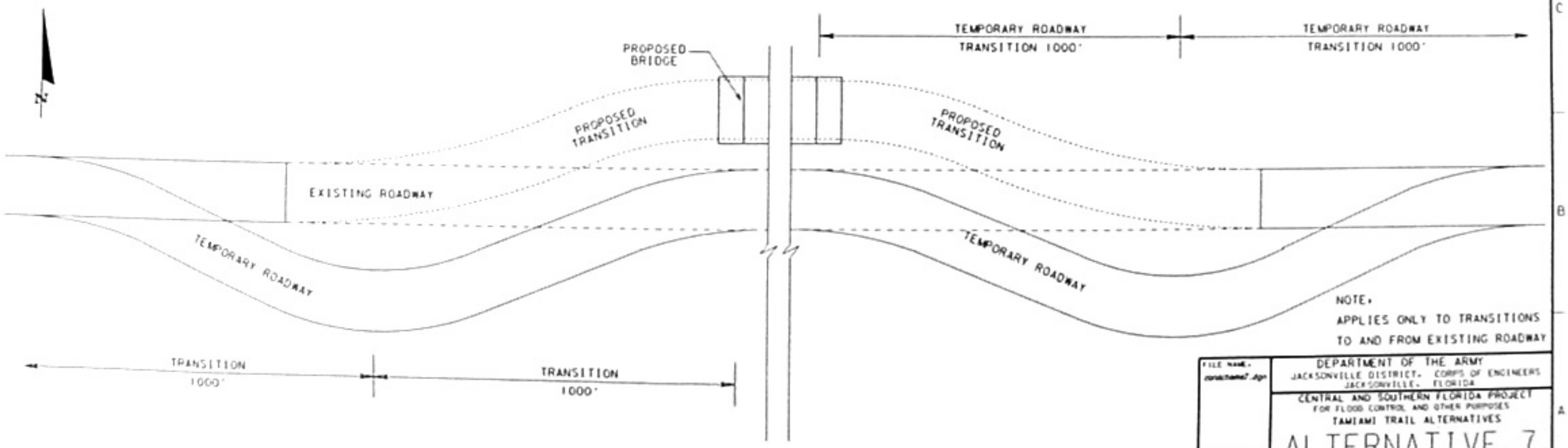
1) CONSTRUCT TEMPORARY ROADWAY.
2) SHIFT TRAFFIC ONTO TEMPORARY ROADWAY.



PHASE IVB

1) REMOVE EXISTING ROADWAY AS REQUIRED FOR CONSTRUCTION OF PROPOSED ALIGNMENT.
2) CONSTRUCT PROPOSED ROADWAY TRANSITION.
3) SHIFT TRAFFIC ONTO NEW ROADWAY.
4) REMOVE TEMPORARY ROADWAY.

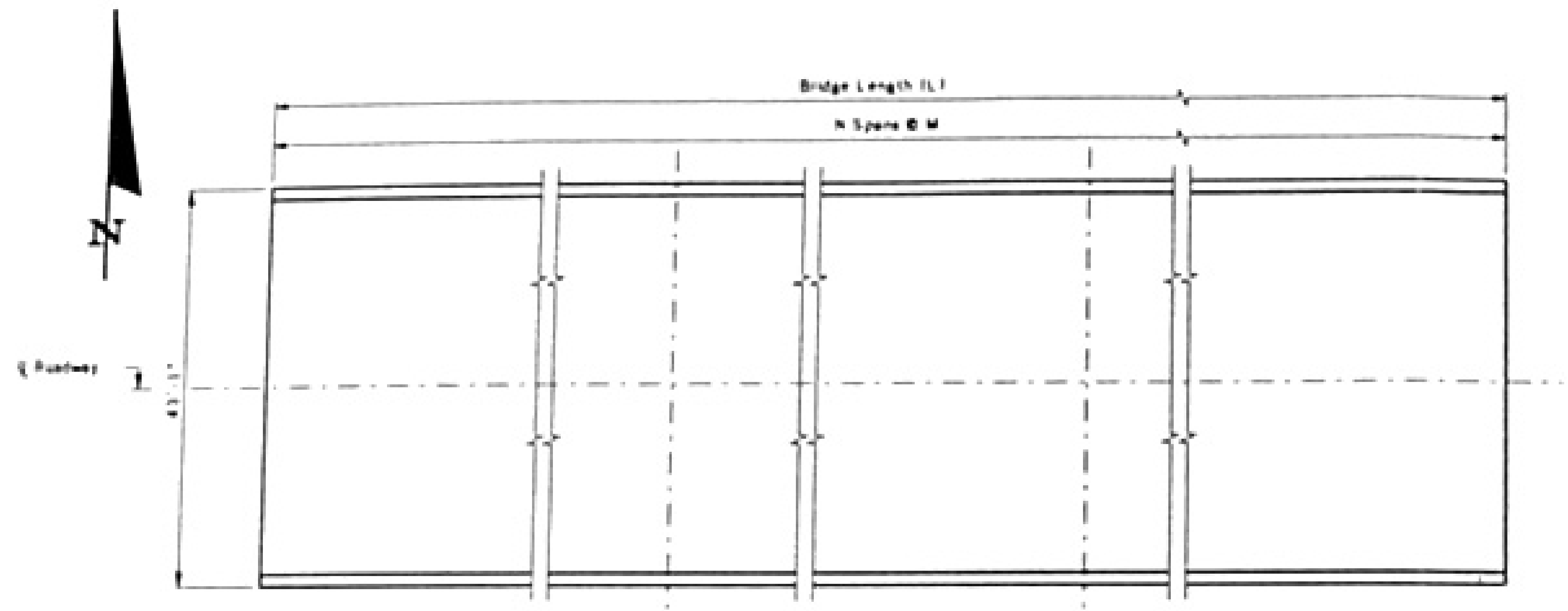




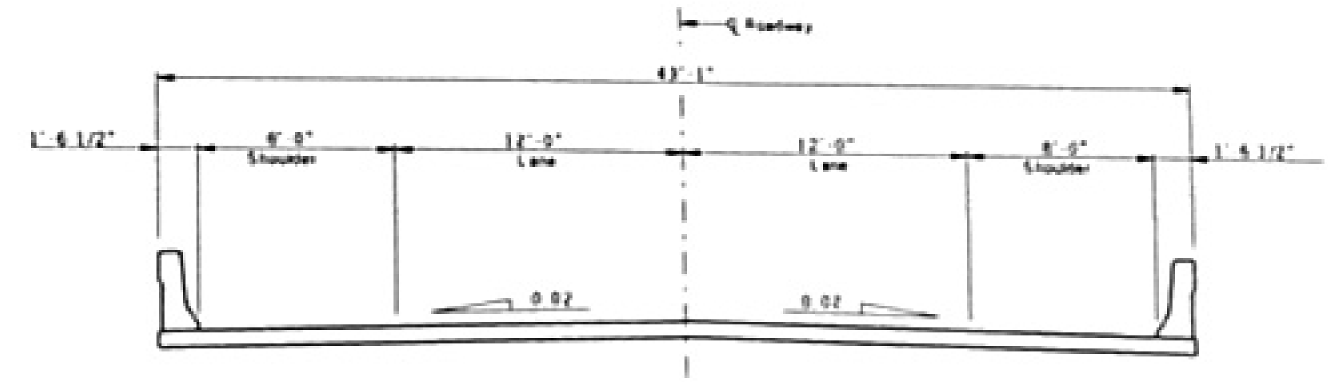
TEMPORARY ROADWAY TRANSITIONS

NOTE:
APPLIES ONLY TO TRANSITIONS TO AND FROM EXISTING ROADWAY

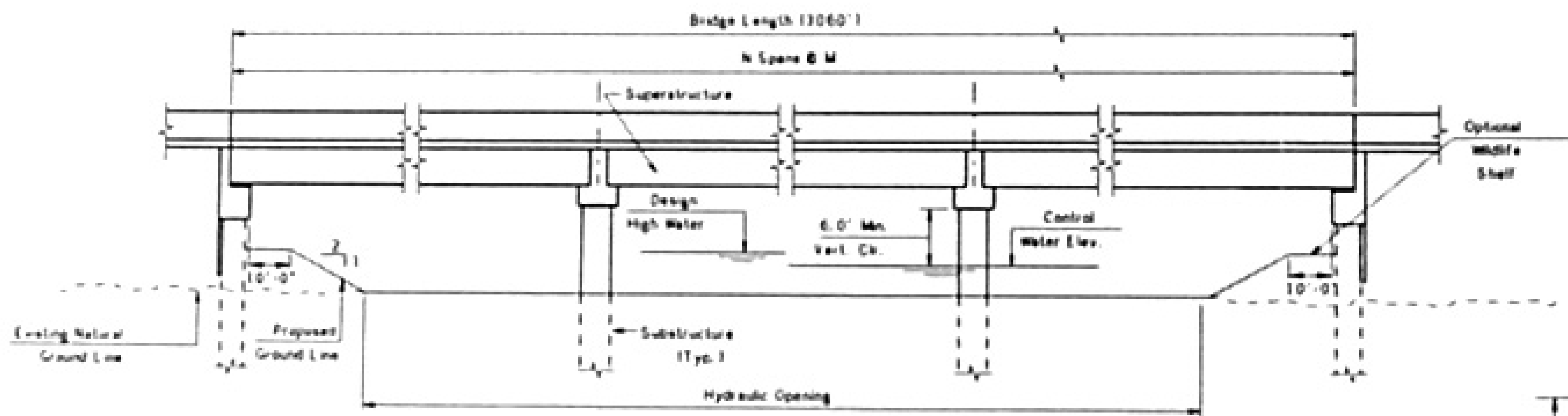
FILE NAME: corsichome7.dgn
DESIGN ENG.: SS
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 7
INV. NO. DACW17-89-D-0015
DATED: 8-AUG-2000
SCALE: AS'S
DRAWING NO. PLATE A7-9



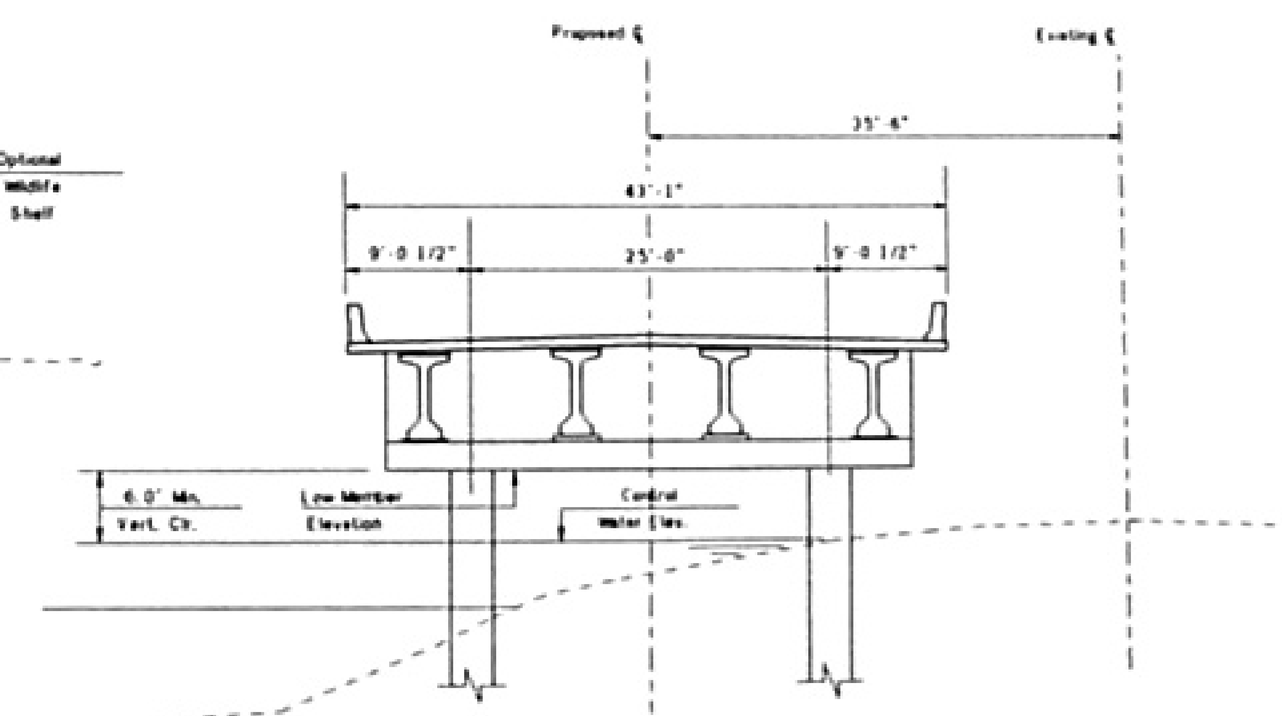
BRIDGE PLAN



BRIDGE TYPICAL SECTION



BRIDGE ELEVATION



SECTION
(LOOKING EAST)

Bridge Number	Bridge Type	Bridge Length (L)	Hydraulic Opening	Number of Spans (N)	Span Lengths (M)	Superstructure Type	Substructure Type	Design High Water	Control Water Elev.	Low Member Elevation
1	H	3060'	N/A	29	105.52'	AASHTO Type V	36" Drilled Shaft	9.3'	7.5'	13.5'

BRIDGE DATA

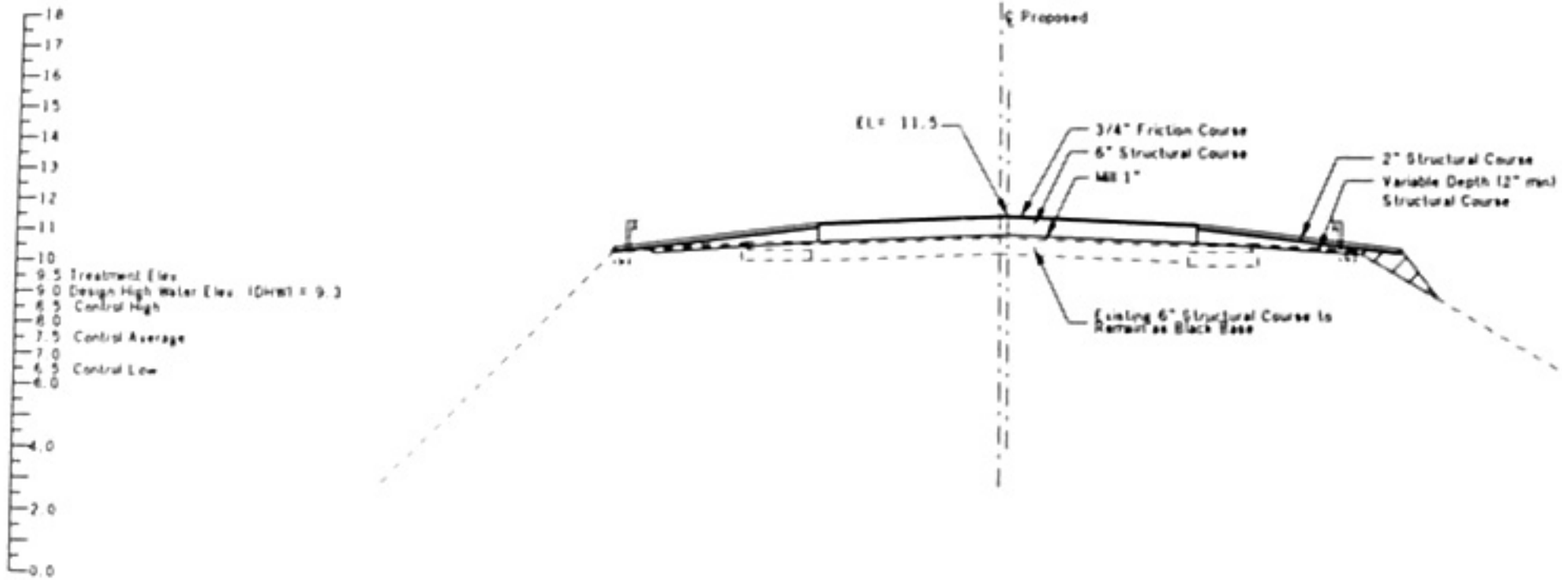
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

DRAWING NO. A7-10

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



LEGEND

▨ = Select Fill (A-1, A-3)

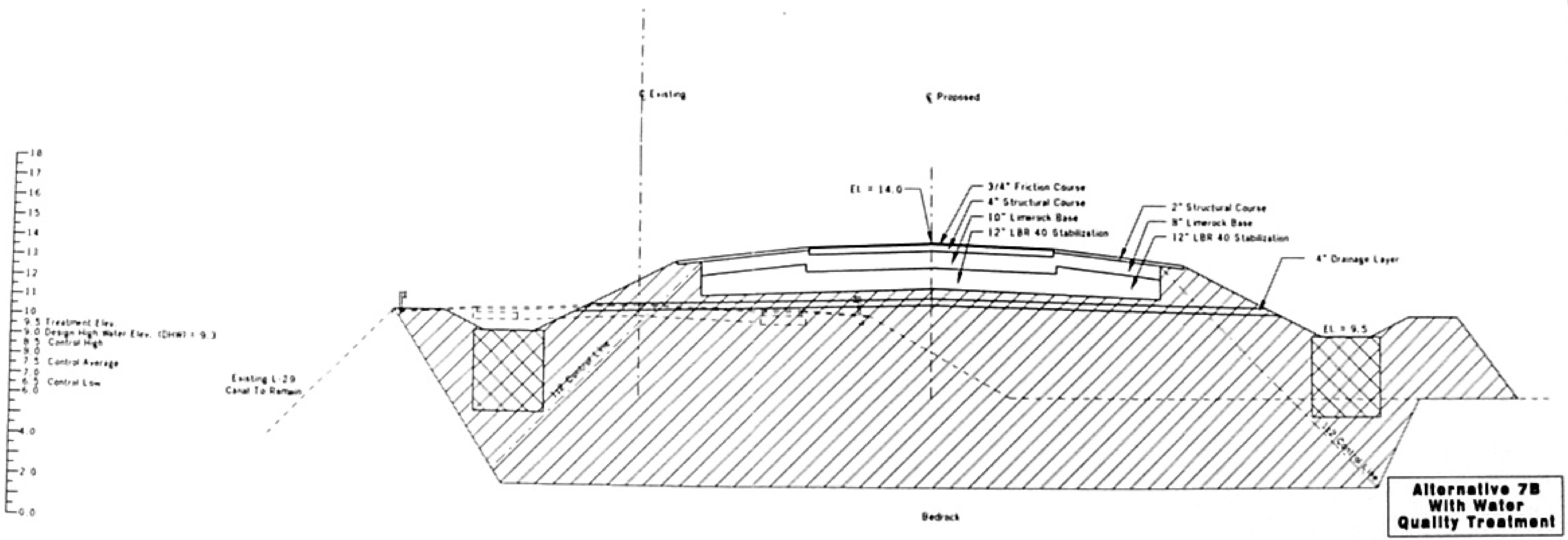
TYPICAL SECTION
EMBANKMENT SECTION FOR ALTERNATIVE 7A

Alternative 7A Without Water Quality Treatment

LOOKING EAST

1" : 10' HORIZONTAL
1" : 5' VERTICAL

FILE NAME: 7pan-t.dgn	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA
	CENTRAL AND SOUTHERN FLORIDA PROJECT FOR FLOOD CONTROL AND OTHER PURPOSES TAMIAMI TRAIL ALTERNATIVES
DESIGNED: RJ	ALTERNATIVE 7
CAD BY: MF / CHK. BY: JB	INV. NO. DACW17-79-D-0025 / SIZE: D / DRAWING NO. PLATE A7-11
	DATED: 4-DEC-2000
	SCALE: AS SHOWN / DATED:



LEGEND

- = Select Fill (A-1, A-3)
- = Fine Aggregate (902-4)

TYPICAL SECTION
EMBANKMENT SECTION FOR ALTERNATIVE 7B

LOOKING EAST

1" = 10' HORIZONTAL
1" = 5' VERTICAL

FILE NAME: Typ-w.dgn

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 7

DESIGN ENG.: AJ

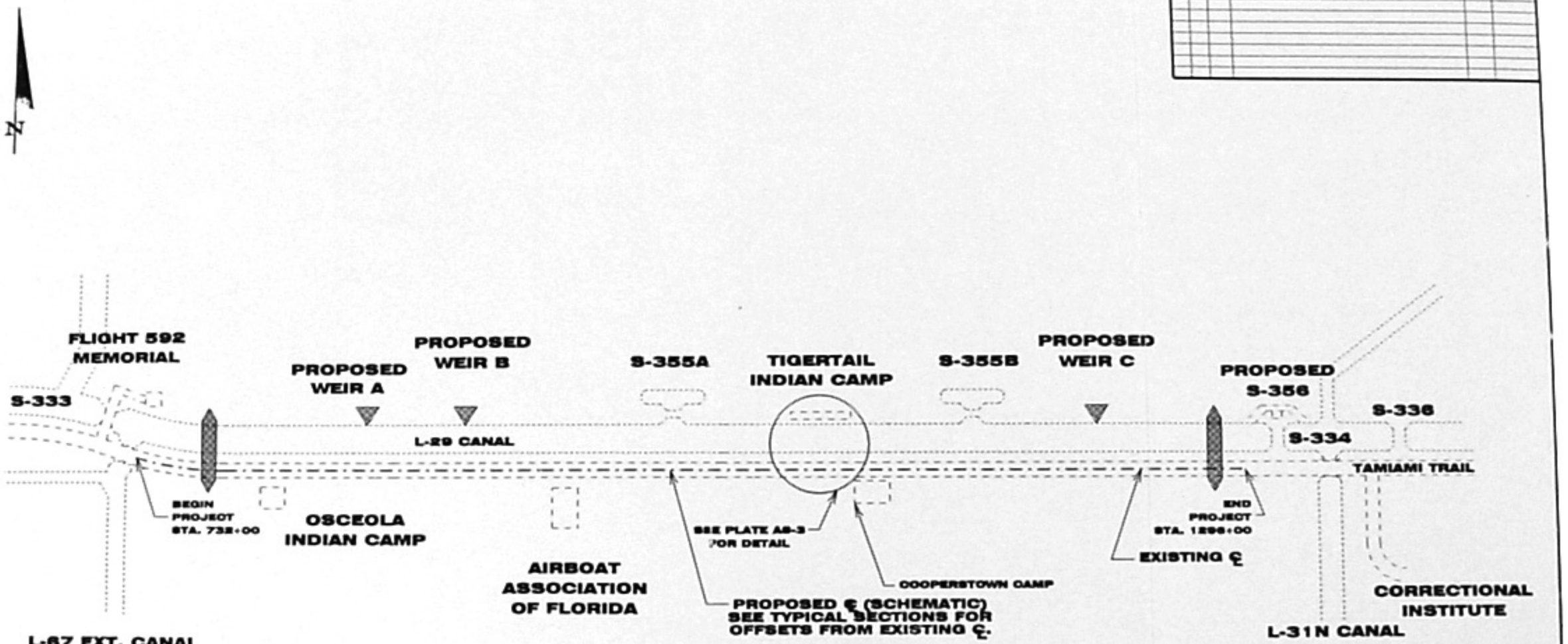
CAD BY: RF | CKD. BY: JA

INV. NO. DACW17-99-D-0005

DATED: 14-DEC-2000

DRAWING NO. PLATE AT-12

SCALE: AS SHOWN | DATED:



REVISIONS

NO.	BY	DATE	DESCRIPTION	DATE	APPROVED

LEGEND

PROPOSED WILDLIFE CROSSING

NOTE:

BOX CULVERTS TO BE SPACED THROUGHOUT THE ALIGNMENT. THE EXACT LOCATION WILL BE DETERMINED DURING FINAL DESIGN.

EXISTING ALIGNMENT WITH RAISED PROFILE AND ADDITIONAL CULVERTS

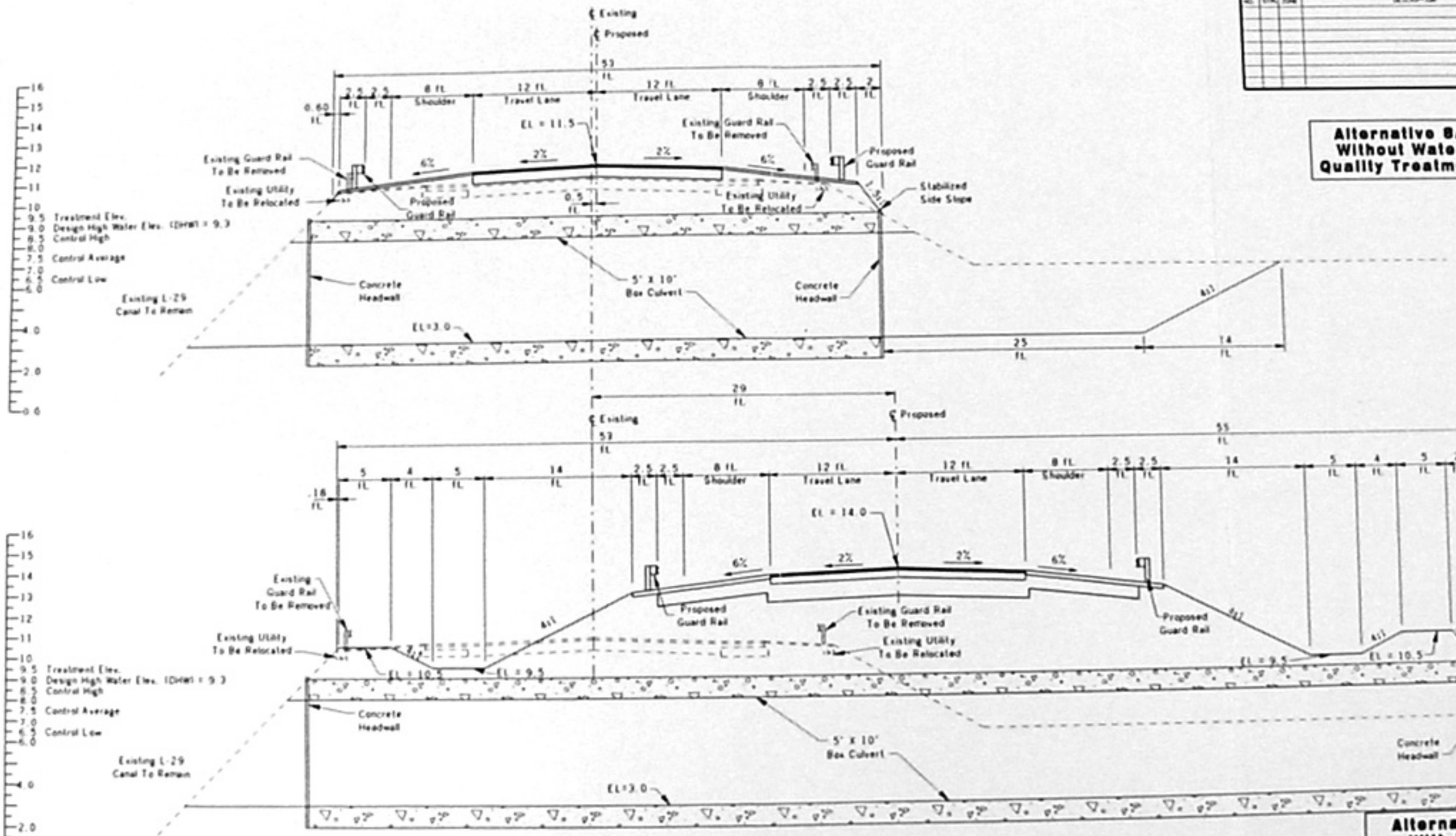
FILE NAME: a8.dgn

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 8

DESIGN ENG.: JR
CAD BY: JR
CHK. BY: DK
INV. NO. DACW17-80-C-0035
DATED: 8-AUG-2001
SIZE:
DRAWING NO. PLATE A8-1
SCALE: AS
DATED:



REVISIONS

NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

Alternative 8A Without Water Quality Treatment

Alternative 8B With Water Quality Treatment

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

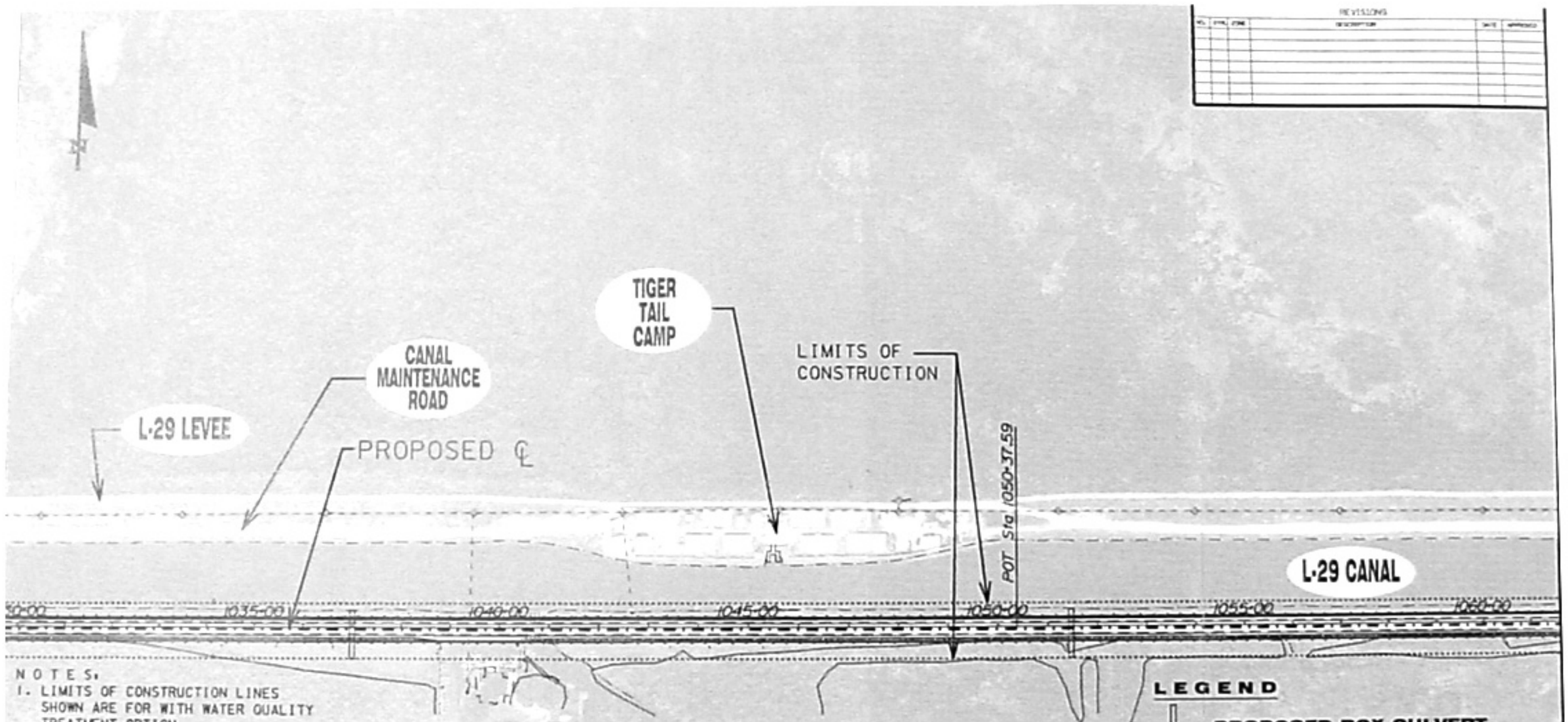
TYPICAL SECTION
EXISTING ALIGNMENT WITH RAISED PROFILE AND ADDITIONAL CULVERTS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 8

PLATE A8-2



NOTES:

1. LIMITS OF CONSTRUCTION LINES SHOWN ARE FOR WITH WATER QUALITY TREATMENT OPTION
2. 24 BOX CULVERTS ARE TO BE INSTALLED FOR ALTERNATIVE 8A (EXISTING CULVERTS WILL REMAIN) ALONG THE 11-MILE ALIGNMENT. 40 BOX CULVERTS ARE TO BE INSTALLED FOR ALTERNATIVE 8B (EXISTING CULVERTS WILL BE REMOVED) ALONG THE 11-MILE ALIGNMENT.
3. PROPOSED CULVERT LOCATIONS ARE TO BE DETERMINED. THEY ARE SHOWN HERE FOR ILLUSTRATION PURPOSES ONLY.

LEGEND

PROPOSED BOX CULVERT

EXISTING ALIGNMENT WITH RAISED PROFILE AND ADDITIONAL CULVERTS

REVISIONS

NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

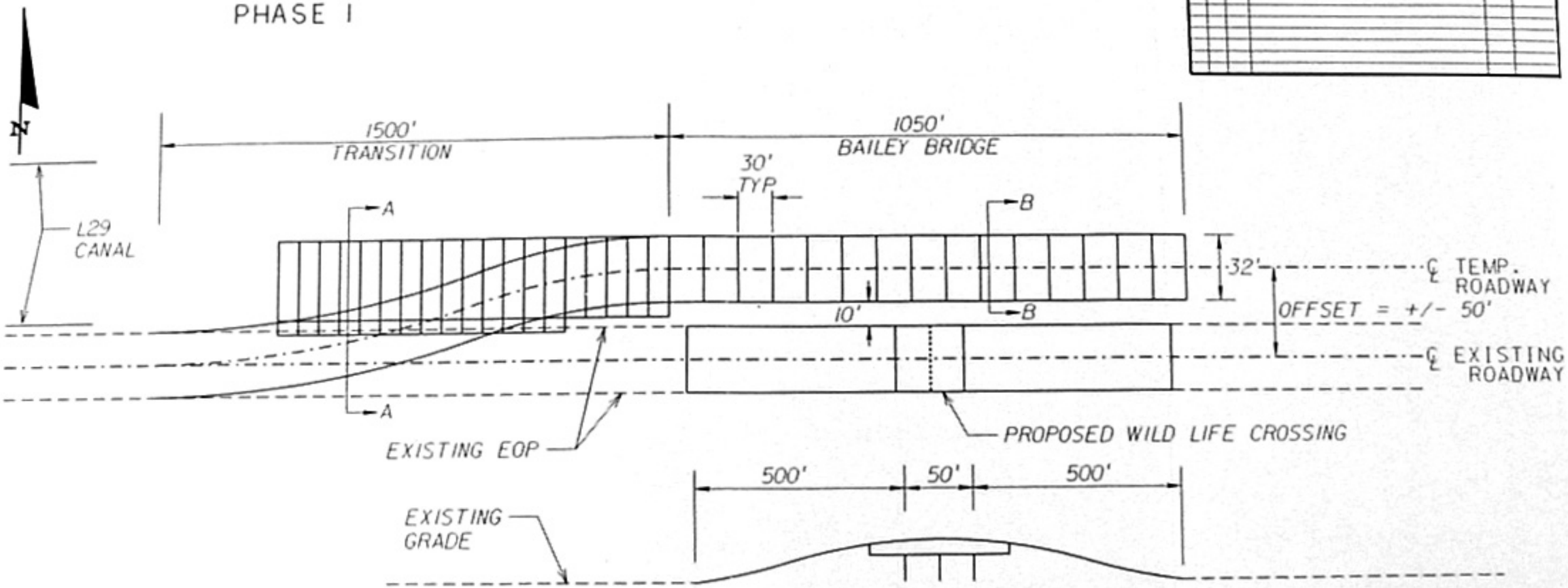
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

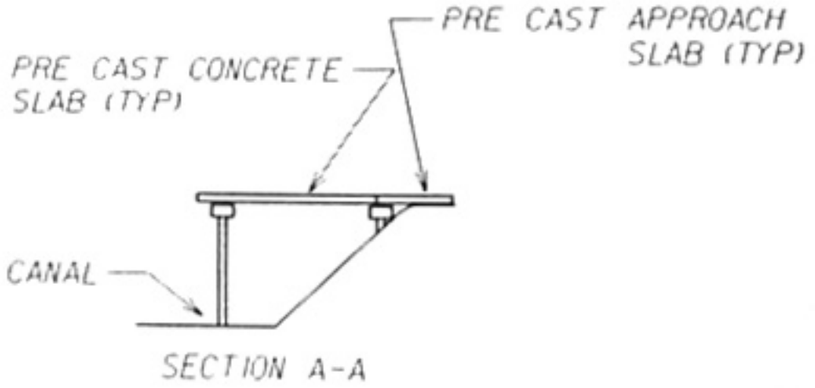
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 8

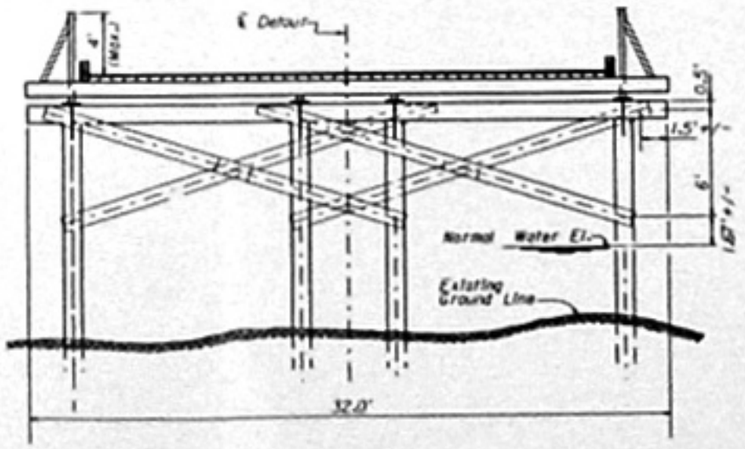
DRAWING NO: PLATE A8-3

PHASE I





SECTION A-A

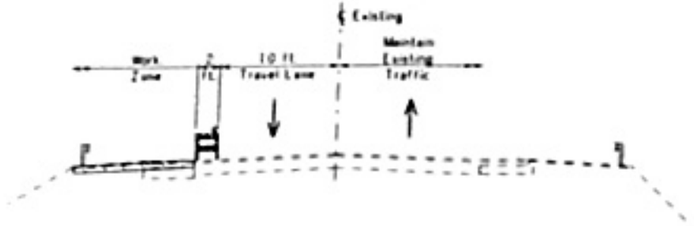


SCHEMATIC SECTION B-B

TEMPORARY ALIGNMENT NORTH OF EXISTING ROADWAY

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES
ALTERNATIVE 8
PLATE A8-4

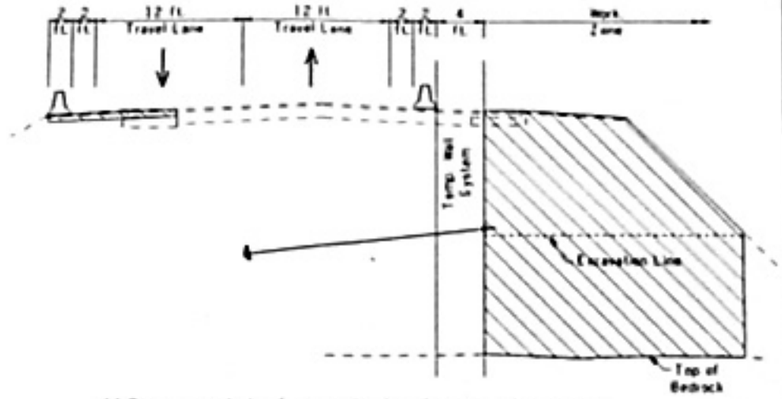
PHASE I I A



1) Remove Existing Guardrail on north side.
2) Place temporary pavement on north shoulder.

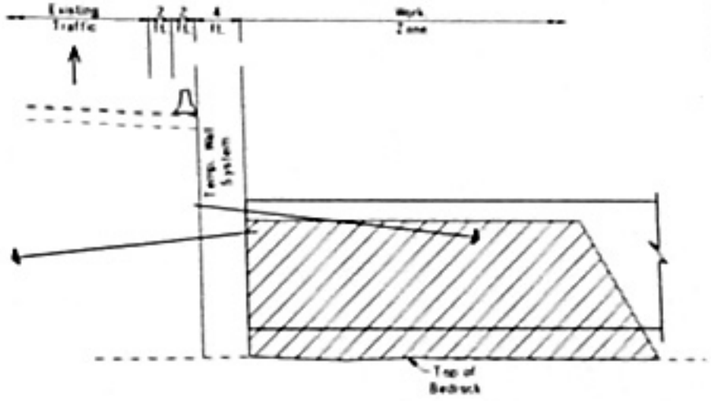
NOTE: Work in Phase I is to be done in 1/4 mile segments.

PHASE I I B



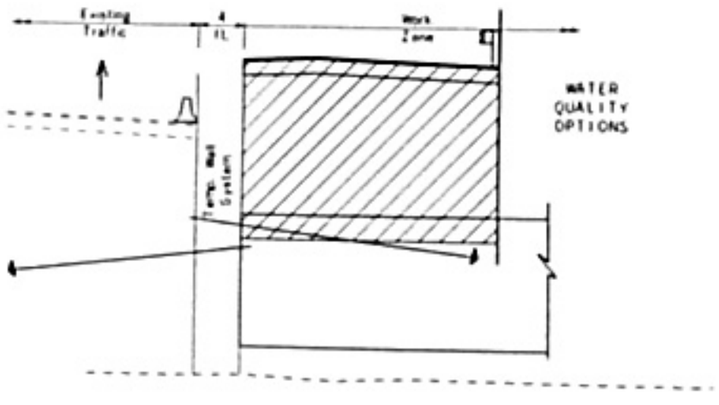
1) Place concrete barrier on north side of Westbound travel lane.
2) Shift existing traffic
3) Place concrete barrier on south side of Eastbound travel lane.
4) Begin installation of Temporary Wall System
5) Excavate on south side of Temporary Wall System to El. 7.0.
6) Install tie-back anchorage system for Temporary Wall.
7) Excavate remaining fill to top of Bedrock.

PHASE I I C



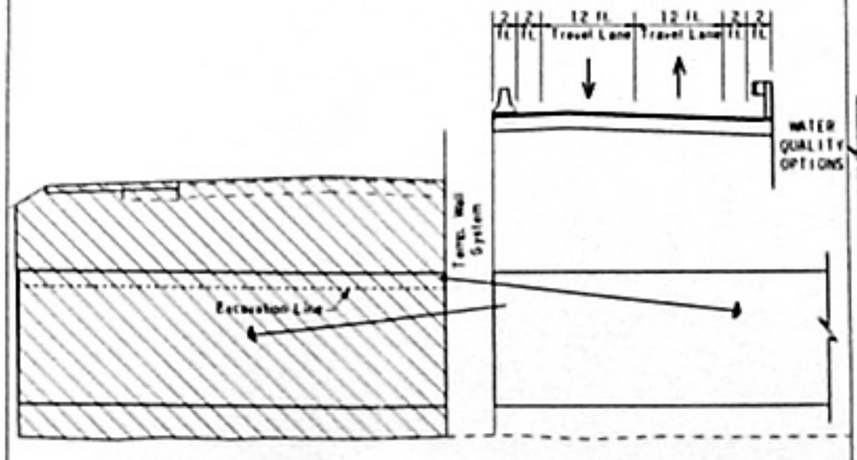
1) Fill Earthwork up to El. 3.0
2) Install Box Culvert on south side of Temporary Wall at Invert El. 3.0
3) Fill Earthwork up to El. 7.0.
4) Install tie-back anchor on south side of Temporary Wall.

PHASE I I D



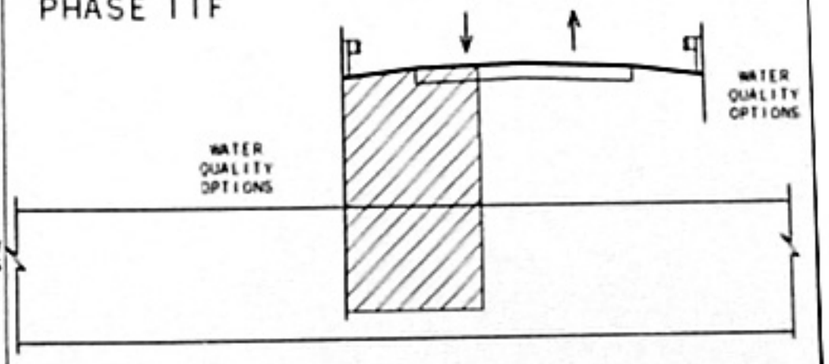
1) Complete construction of new Roadway on south side of Temporary Wall.
2) Contractor shall not proceed to next Phase until all construction activities are complete to this point.

PHASE I I E



1) Shift traffic on to new construction
2) Excavate on north side of temporary wall to El. 7.0.
3) Install tie-back anchorage system for temporary wall.
4) Excavate remaining fill to top of bedrock, cutting off soil anchor installed in Phase II.
5) Fill Earthwork to EL 3.0.
6) Install Box Culverts on the north side of Temporary Wall at Invert EL 3.0.

PHASE I I F



1) Complete construction of Box Culvert.
2) Fill Earthwork up to tie-back. Cut off anchorage.
3) Complete construction on north side of temporary wall.
4) Shift traffic to outside lanes of roadway.
5) Complete overlay activities to finalize crown location.
6) Shift traffic to ultimate location.

REVISIONS

NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

FILE NAME: ment8.dgn

DESIGN ENG.: SS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

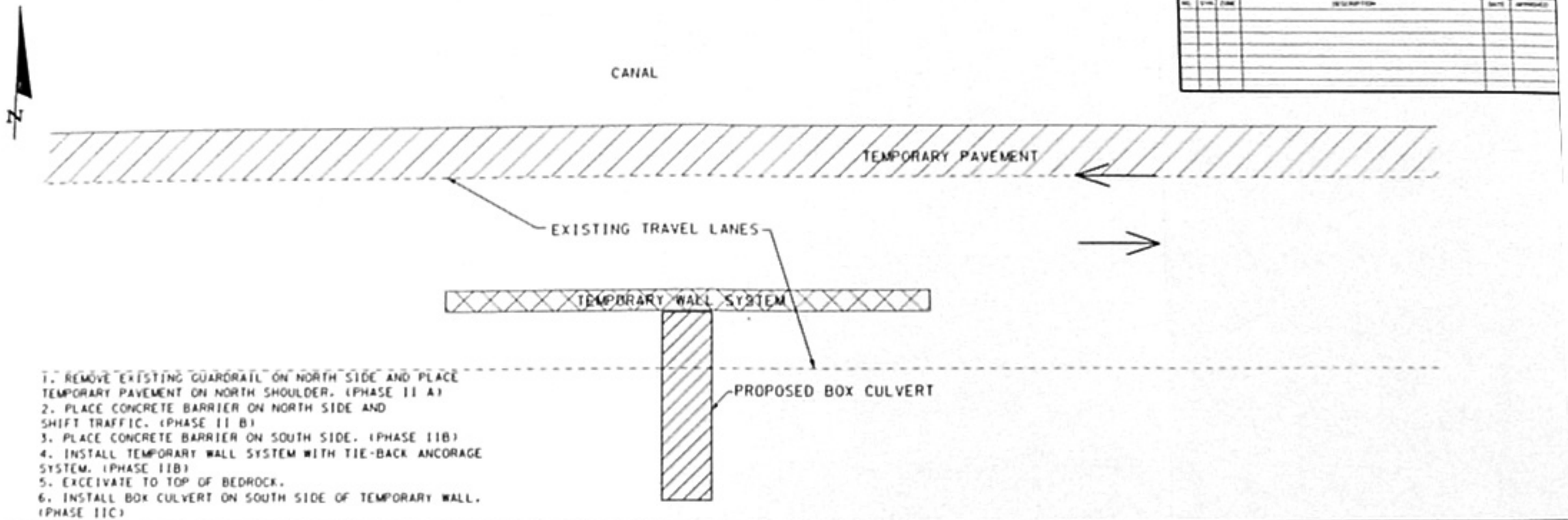
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES

TAMIAMI TRAIL ALTERNATIVES

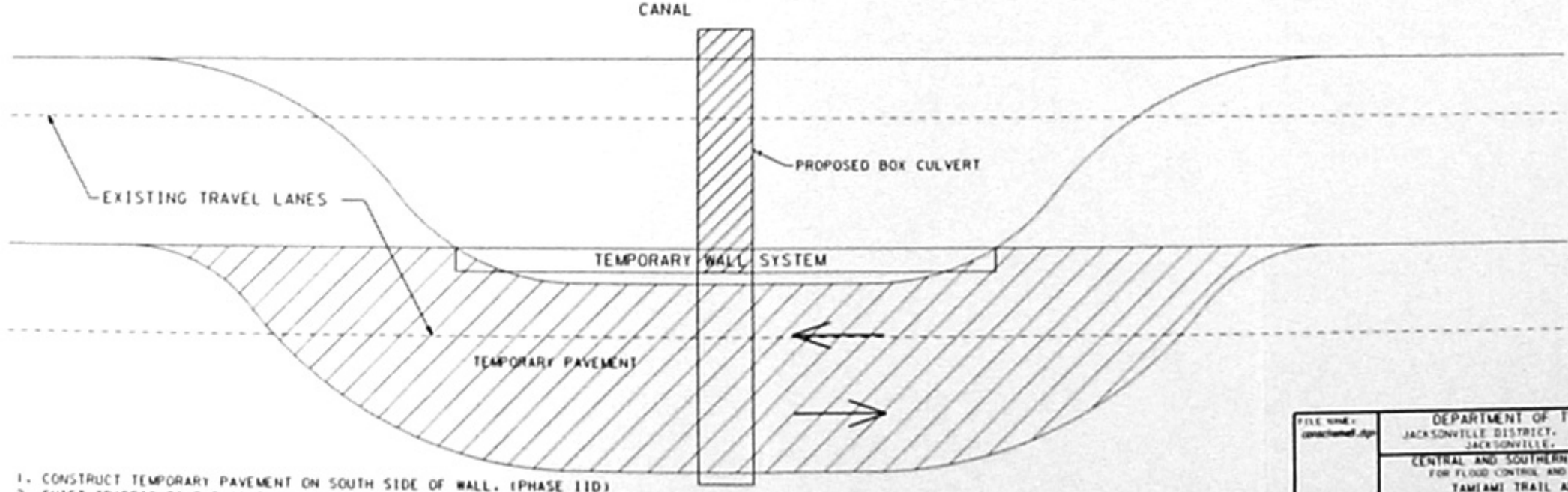
CONSTRUCTION PHASES ALTERNATIVE 8

CAD BY:	CK'D BY:	DRW. NO.	SIZE	DRAWING NO.
JR	DH	DACW17-90-D-0005		PLATE 8-5
		DATED: 8-MAY-2000		
		SCALE: AS'S	DATED:	

REVISIONS					
NO.	SYM	ZONE	DESCRIPTION	DATE	APPROVED



1. REMOVE EXISTING GUARDRAIL ON NORTH SIDE AND PLACE TEMPORARY PAVEMENT ON NORTH SHOULDER. (PHASE II A)
2. PLACE CONCRETE BARRIER ON NORTH SIDE AND SHIFT TRAFFIC. (PHASE II B)
3. PLACE CONCRETE BARRIER ON SOUTH SIDE. (PHASE IIB)
4. INSTALL TEMPORARY WALL SYSTEM WITH TIE-BACK ANCORAGE SYSTEM. (PHASE IIB)
5. EXCEIVATE TO TOP OF BEDROCK.
6. INSTALL BOX CULVERT ON SOUTH SIDE OF TEMPORARY WALL. (PHASE IIC)



1. CONSTRUCT TEMPORARY PAVEMENT ON SOUTH SIDE OF WALL. (PHASE IID)
2. SHIFT TRAFFIC TO THE SOUTH.
3. INSTALL BOX CULVERT ON NORTH SIDE OF TEMPORARY WALL. (PHASE II E)
4. COMPLETE ROADWAY CONSTRUCTION. (PHASE II F)
5. SHIFT TRAFFIC TO ULTIMATE LOCATION.

CONSTRUCTION OF PROPOSED BOX CULVERTS

DEPARTMENT OF THE ARMY
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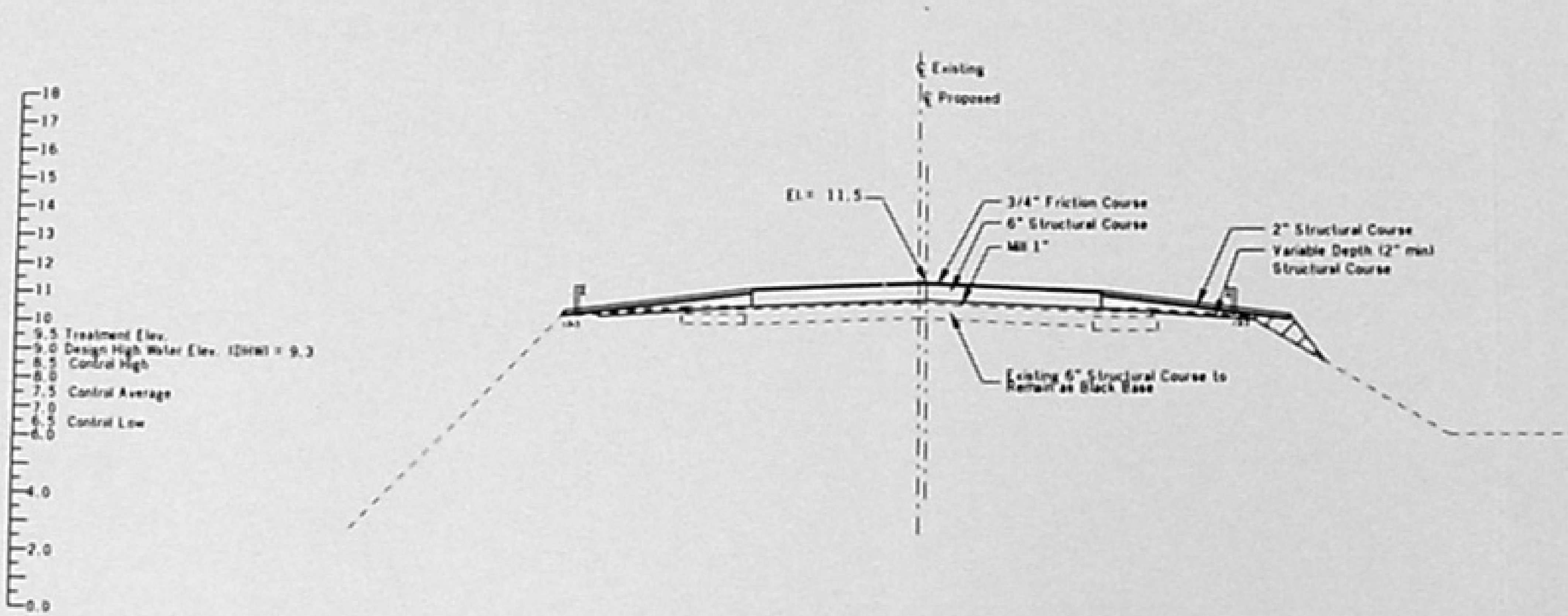
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 8

PLATE A8-6



LEGEND

▨ = Select Fill (A-1, A-3)

TYPICAL SECTION
EMBANKMENT SECTION FOR ALTERNATIVE 8A

Alternative 8A Without Water Quality Treatment

LOOKING EAST

1" = 10' HORIZONTAL
1" = 5' VERTICAL

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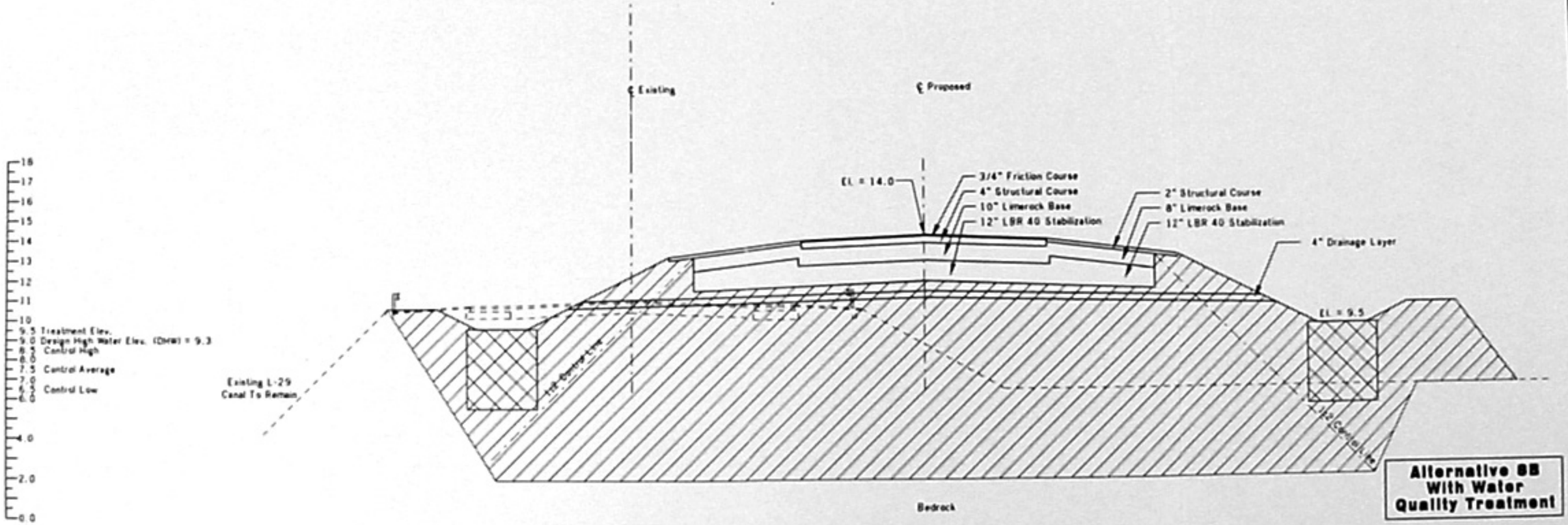
CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 8

DRAWING NO.: PLATE A8-7

SCALE: AS SHOWN

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



LOOKING EAST

1" : 10' HORIZONTAL
1" : 5' VERTICAL

LEGEND

= Select Fill (A-1, A-3)

= Fine Aggregate (902-4)

TYPICAL SECTION
EMBANKMENT SECTION FOR ALTERNATIVE 8B

FILE NAME:

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

ALTERNATIVE 8

DESIGN ENG.:

LAID BY:

CKD. BY:

INV. NO.

DATED:

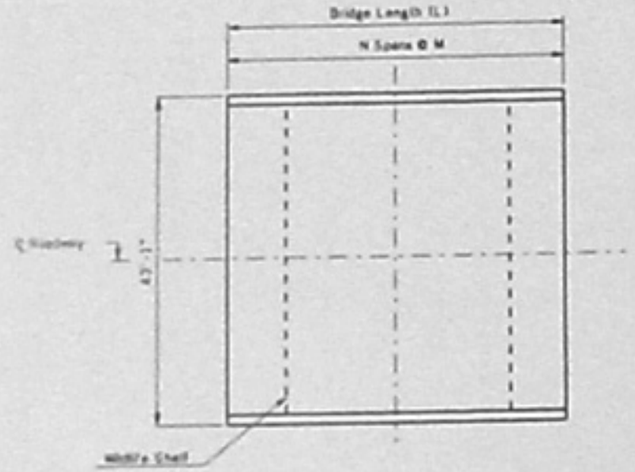
SIZE

DRAWING NO.
PLATE A8-8

SCALE: AS SHOWN

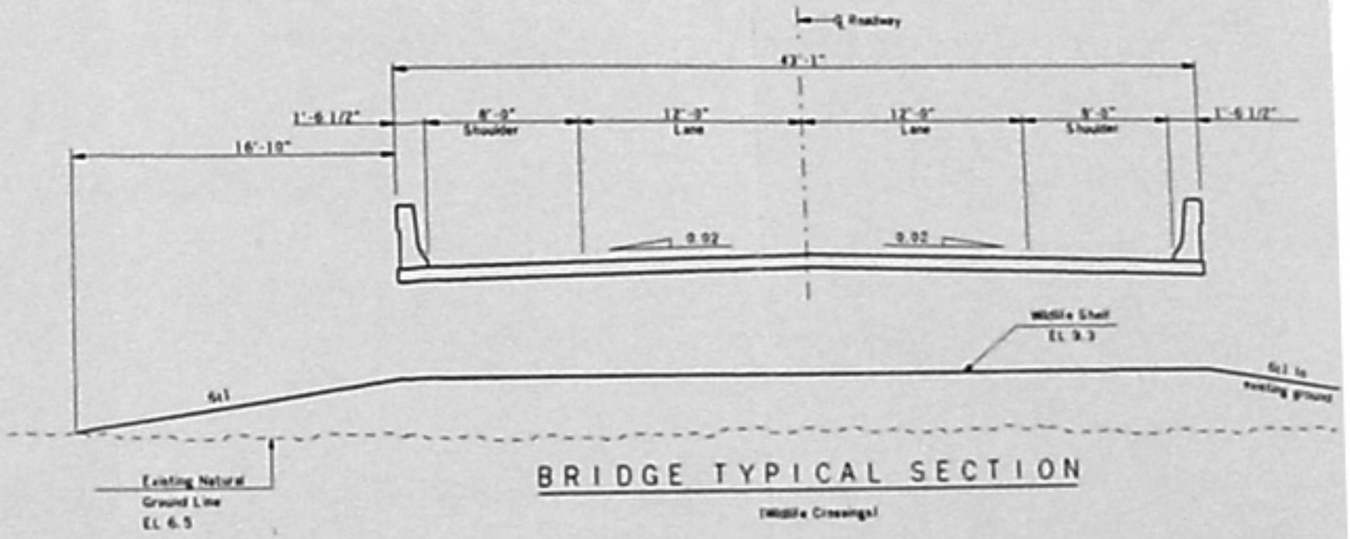
DATED:

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



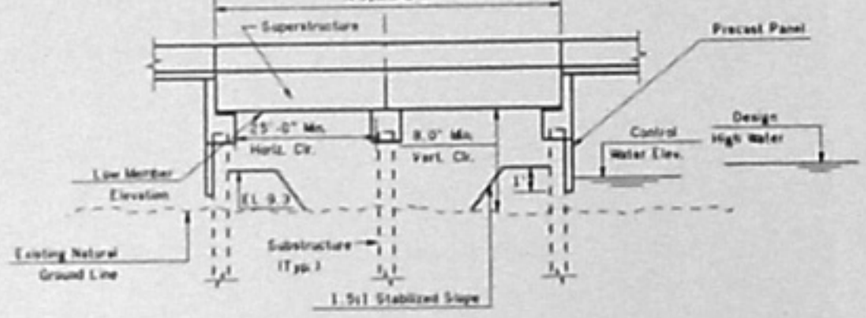
BRIDGE PLAN

(Wildlife Crossings)



BRIDGE TYPICAL SECTION

(Wildlife Crossings)



BRIDGE ELEVATION

(Wildlife Crossings)

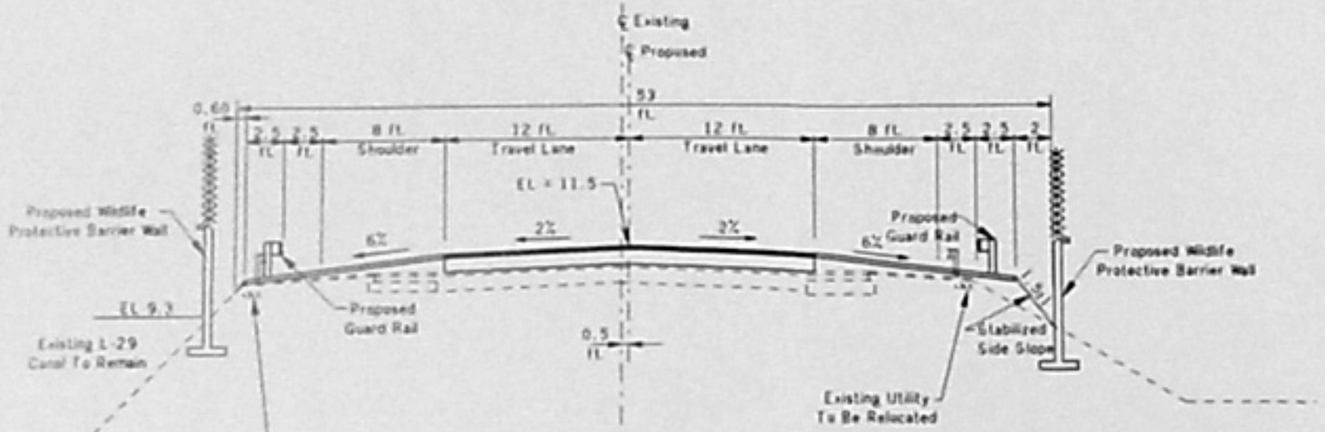
Bridge Number	Bridge Type	Bridge Length (L)	Hydraulic Opening	Number of Spans (N)	Span Lengths (M)	Superstructure Type	Substructure Type	Design High Water	Control Water Elev.	Low Member Elevation	Existing Natural Ground Elevation
1	B	55'-00"	N/A	2	27.50'	CIP Flat Slab	18 in. Prestressed Pile	9.3'	7.5'	14.5'	6.5'
2	B	55'-00"	N/A	2	27.50'	CIP Flat Slab	18 in. Prestressed Pile	9.3'	7.5'	14.5'	6.5'

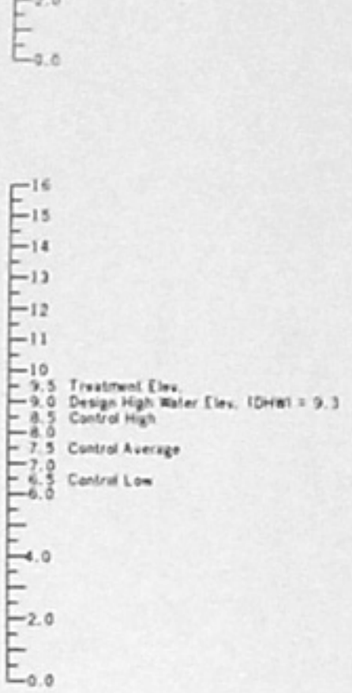
BRIDGE DATA

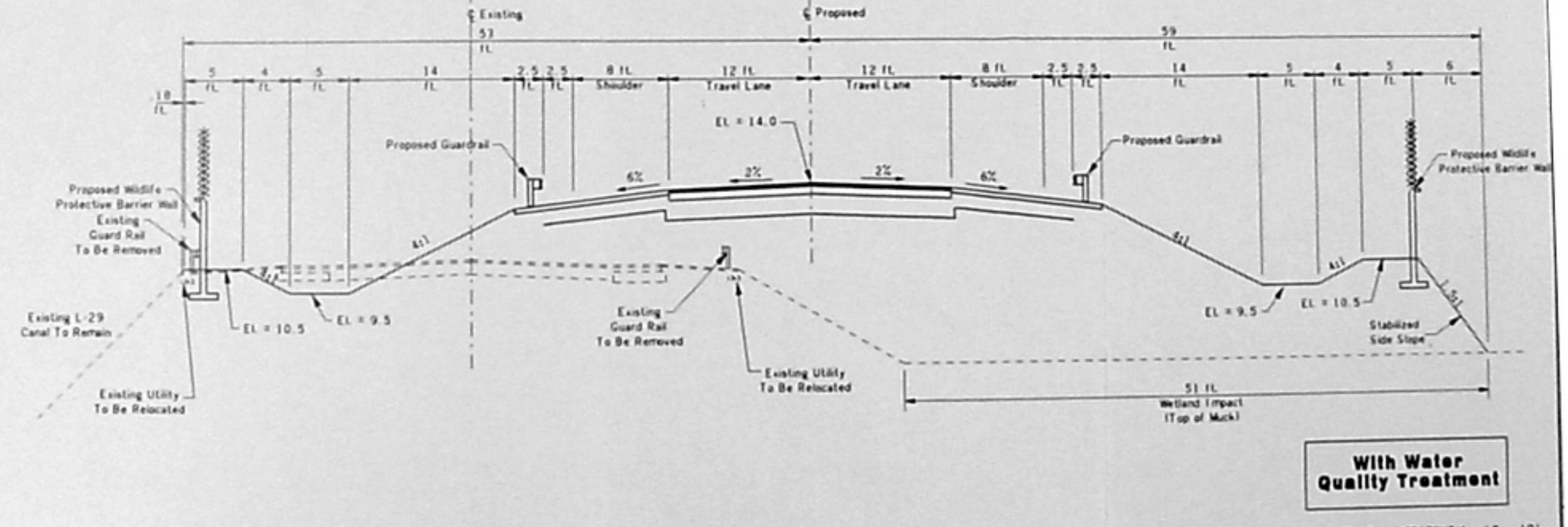
FILE name: wlbrtrs.dgn	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	
	CENTRAL AND SOUTHERN FLORIDA PROJECT FOR FLOOD CONTROL AND OTHER PURPOSES TAMIAMI TRAIL ALTERNATIVES	
DESIGN ENG.: FD	WILDLIFE UNDERCROSSING BRIDGE DETAILS	
DES. BY: CL / DET. BY: JF	INV. NO. [illegible] / DATED: [illegible]	SIZE: / DRAWING NO.: WL-1
	SCALE: 1"=40' / DATED:	
	D.O. FILE NO.: 0005	

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

Without Water Quality Treatment







With Water Quality Treatment

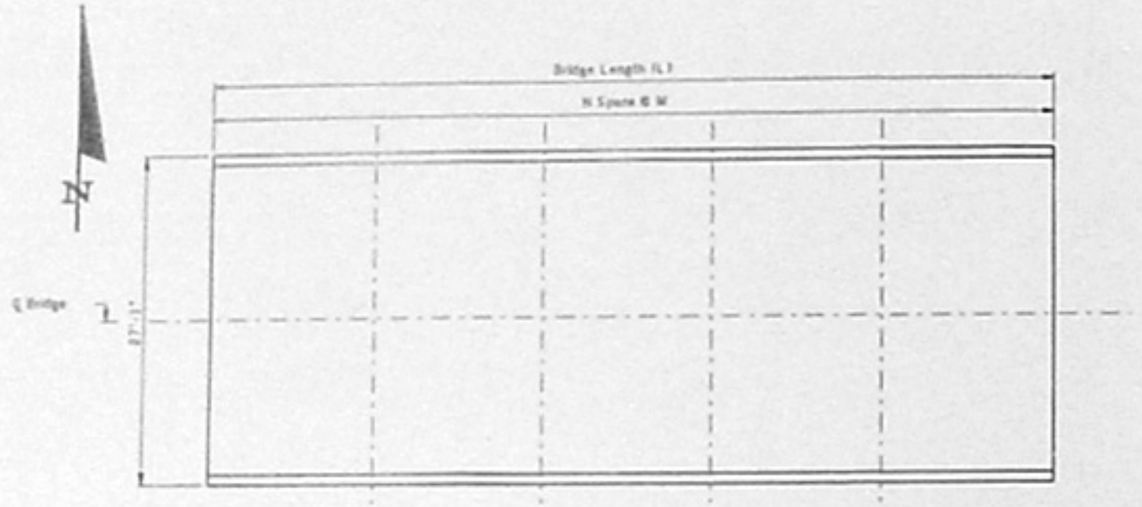
TYPICAL SECTION WILDLIFE PROTECTIVE BARRIER: WALL DETAILS

LOOKING EAST

SCALE - HORIZONTAL 1" = 10'
VERTICAL 1" = 5'

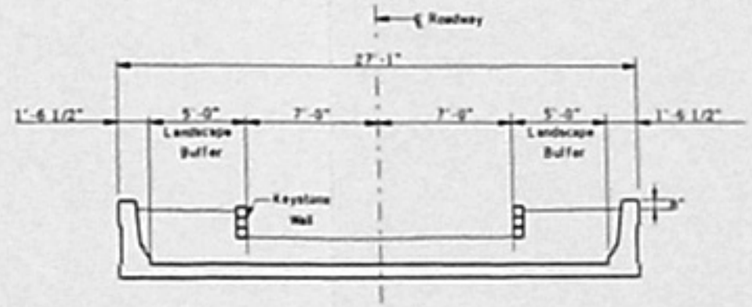
FILE NAME: wall details.dgn	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA
DESIGN ENG.: SS	CENTRAL AND SOUTHERN FLORIDA PROJECT FOR FLOOD CONTROL AND OTHER PURPOSES TAMIAMI TRAIL ALTERNATIVES WILDLIFE PROTECTIVE BARRIER WALL DETAILS
CAD BY: JR / CHK. BY: JW	INV. NO. DACW67-00-D-0015 / SIZE / DRAWING NO. WL-2
	DATED: 23-MAY-2001
	SCALE: / DATED:

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED



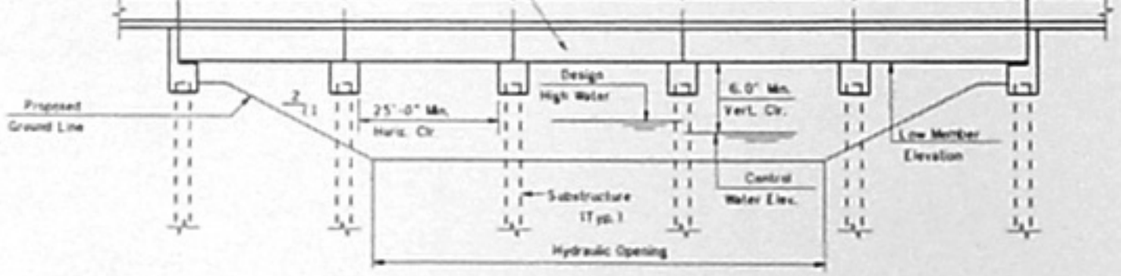
BRIDGE PLAN

Canal Crossing



BRIDGE TYPICAL SECTION

Wildlife Canal Crossing



BRIDGE ELEVATION

Canal Crossing

Bridge Length (L)	Hydraulic Opening	Number of Spans (N)	Span Lengths (M)	Superstructure Type	Superstructure Type	Design High Water	Control Water Elev.	Low Member Elevation
168.75'	N/A	5	33.75	AASHTO Type II	18 in. Prestressed Pile	10.5'	8.5'	14.5'

BRIDGE DATA

FILE NAME:

DESIGN ENG.: FD

DRAWN BY: CL

CHKD. BY: SF

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

WILDLIFE CANAL CROSSING BRIDGE DETAILS

INIT. NO.:

SIZE:

DRAWING NO.: WL-3

DATED:

SCALE: AS NOTED

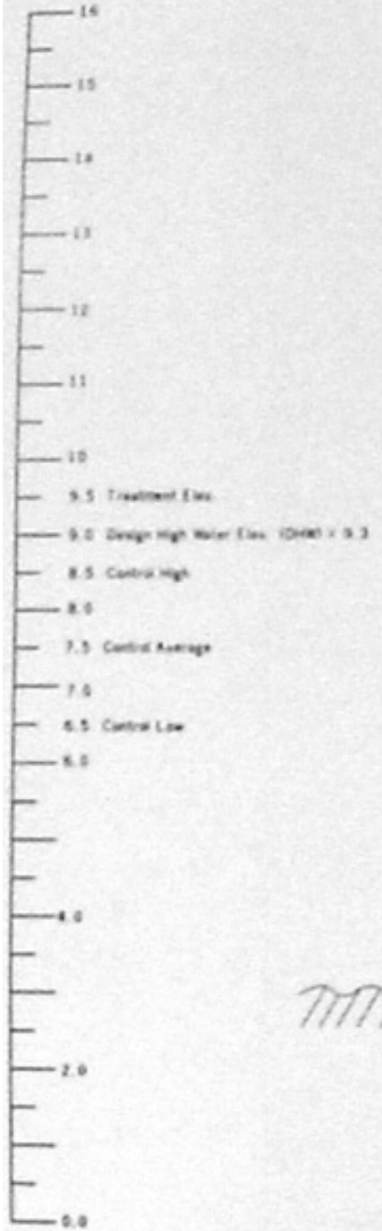
DATED:

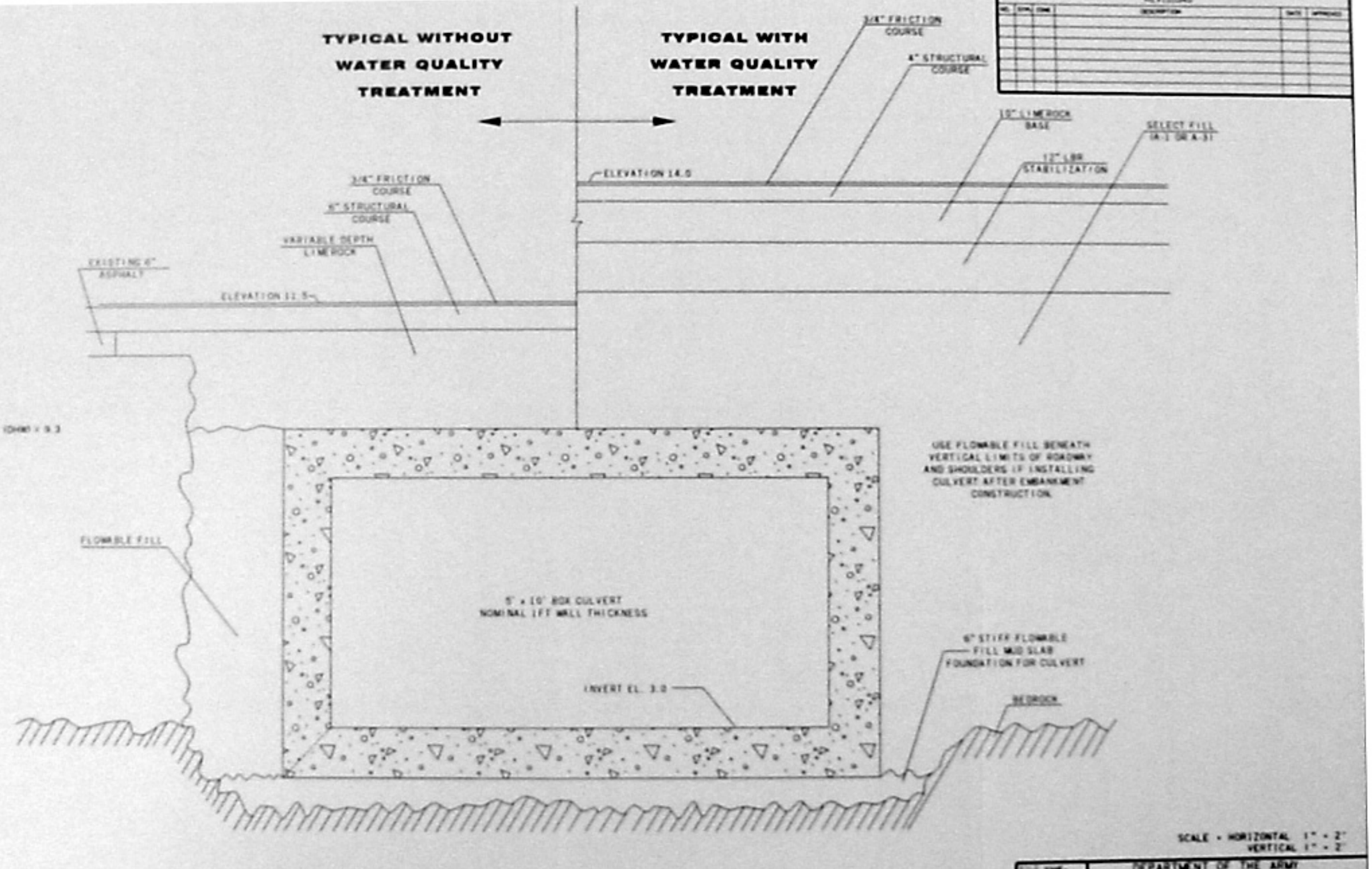
D.O.FILE NO. 0005

REVISIONS					
NO.	SYM.	ZONE	DESCRIPTION	DATE	APPROVED

TYPICAL WITHOUT WATER QUALITY TREATMENT

TYPICAL WITH WATER QUALITY TREATMENT





USE FLOWABLE FILL BENEATH VERTICAL LIMITS OF ROADWAY AND SHOULDERS IF INSTALLING CULVERT AFTER EMBANKMENT CONSTRUCTION.

SCALE - HORIZONTAL 1" = 2'
VERTICAL 1" = 2'

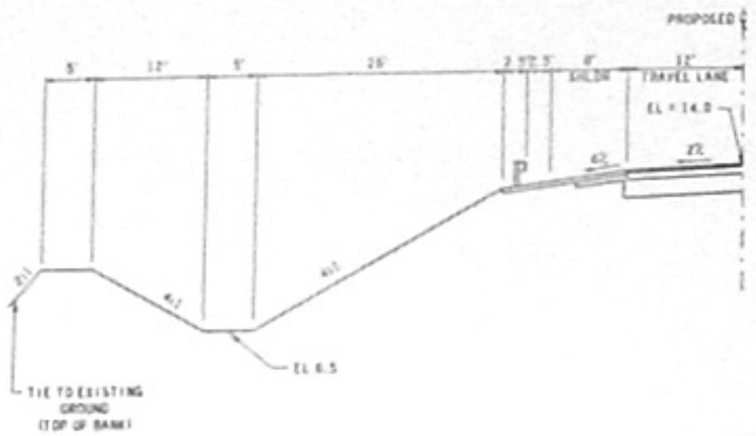
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT- CORPS OF ENGINEERS
JACKSONVILLE- FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

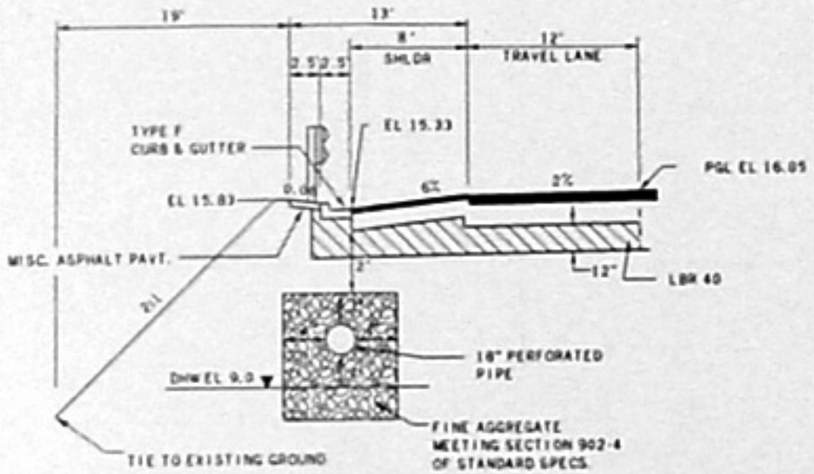
BOX CULVERT DETAILS

PLATE BC-1

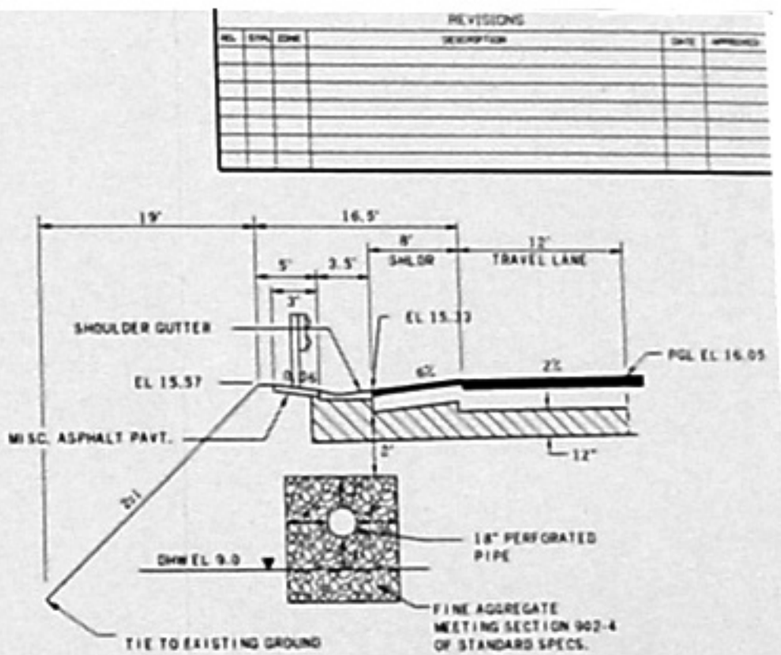
S.D. FILE NO. 0005



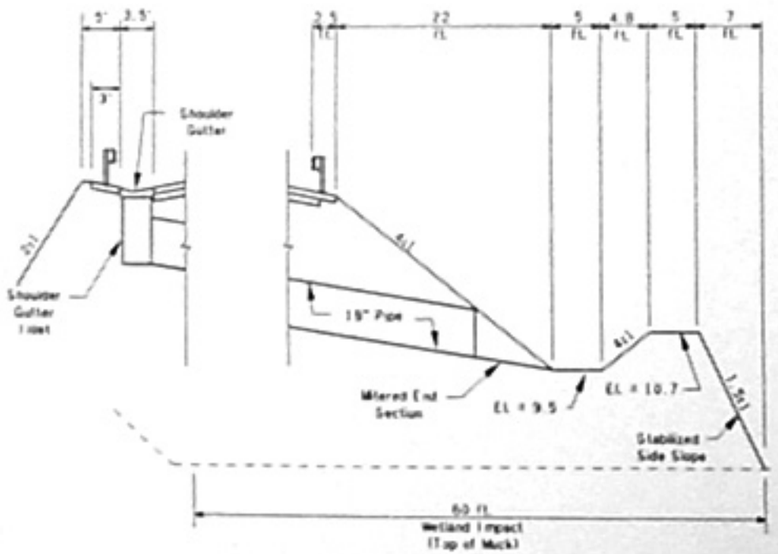
WET DETENTION SYSTEM



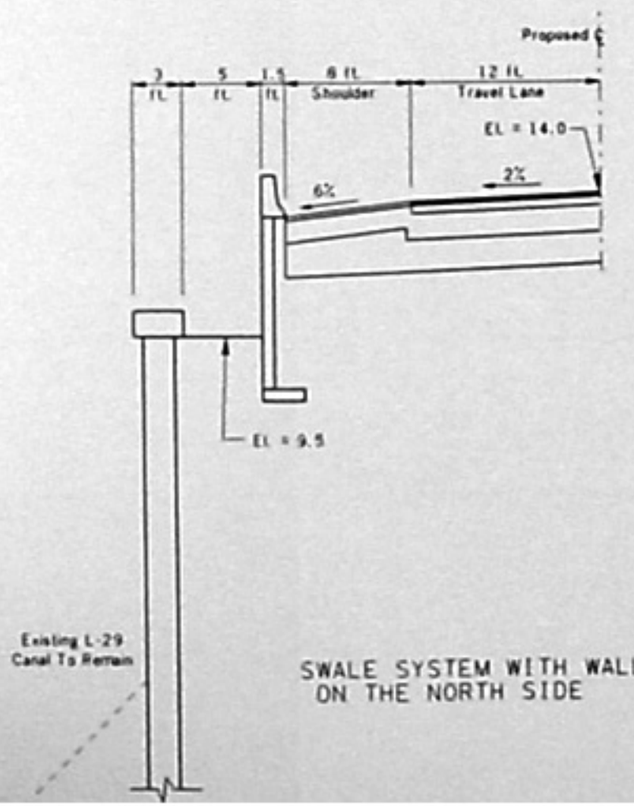
EXFILTRATION TRENCHES WITH CURB AND GUTTER



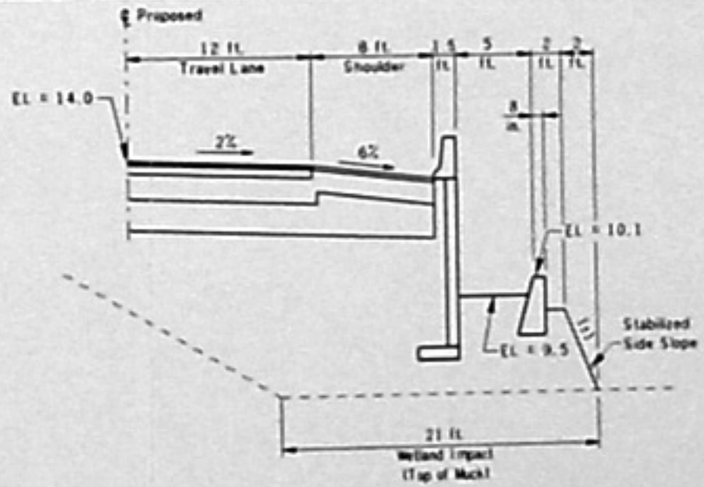
EXFILTRATION TRENCHES WITH SHOULDER GUTTER



SINGLE DRY DETENTION SWALE SYSTEM



SWALE SYSTEM WITH WALLS ON THE NORTH SIDE



SWALE SYSTEM WITH WALLS ON THE SOUTH SIDE

FILE NAME: optionsdf.dgn

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

CENTRAL AND SOUTHERN FLORIDA PROJECT
FOR FLOOD CONTROL AND OTHER PURPOSES
TAMIAMI TRAIL ALTERNATIVES

WATER QUALITY TREATMENT OPTIONS

DESIGN ENG.: JD
CAD BY: JR
DES. BY: JW
INV. NO.:
DATED: 23-MAY-2001
SCALE: NTS
DATED:
DRAWING NO.: PLATE WQ-1